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AN AMERICAN CERAPACHYS, WITH REMARKS ON THE AFFINITIES OF THE CERAPACHYINÆ.[1]

WILLIAM MORTON WHEELER.

The singular ant described in the following pages was discovered by Miss Augusta Rucker within the city limits of Austin, Texas, on May 11 of the current year. Impressed by the peculiar, elongate, and segmentally constricted body of the insect, Miss Rucker fortunately secured nearly all the individuals in the nest, including the apterous queen. The most superficial study showed that the insect could belong to none of the described North or South American genera of Formicidæ. A note from Professor Emery, to whom a few of the specimens were sent, and comparison with some rare ants generously sent me by that gentleman and by Dr. Gustav Mayr, made it perfectly evident that the new form must be assigned to the interesting genus *Cerapachys* (subgenus *Parasyscia*), representatives of which were hitherto known only from the Old World (Africa, Asia and Papuasia).

The *Cerapachys* nest was found about six inches below the surface soil under a layer of large flakes of limestone in the shade of some hackberry trees growing on the banks of Waller Creek. At first only six workers and the queen were taken, but on the following day Miss Rucker and myself succeeded in unearthing four more workers on the same spot. The whole nest could not have contained much more than a dozen specimens. Unfortunately there were no larvæ or pupæ. When first seen the *Cerapachys* were engaged in a battle with some much smaller subterranean ants (*Ponera trigona* var. *opacior*) which seemed to be invading the nest. The new species was slow in its move-

[1] Contributions from the Zoölogical Laboratory of the University of Texas, No. 37.

ments as would be expected in creatures with such long bodies and short legs. They did not "feign death" when roughly handled, though some of them, when held in the forceps, remained motionless in the attitude probably assumed when they are being deported by their sister workers. While creeping about the ants carried their very robust antennæ in a peculiar manner. The scape was held erect or inclined forwards, but hardly in a horizontal or lateral position as in other ants, while the funicle could be folded down onto the front surface of the scape a little obliquely to the side. The habits, so far as these could be inferred from the little I saw of the ants in a living condition, recalled those of *Stigmatomma pallipes* described in a former paper ('00). As the workers are quite blind it seems probable that the species leads a subterranean life, seeking its prey in the soil or under the dead leaves. This seems also to be indicated by the depth at which these small insects were found. The very robust antennæ and the beautifully developed stridulatory apparatus, which occupies the whole of the large membrane between the postpetiolar and first gastric segment, indicate that the senses of contact-odor and hearing are highly developed and may adequately compensate for the absence of visual organs.

On the 22d of May, Mr. C. T. Brues found a solitary worker of the same *Cerapachys* under a stone at Pease Park, about two miles from the locality in which the species was first taken. That the insect is extremely rare is shown by the fact that it had not been found before during three years of careful collecting in the vicinity of Austin.

CERAPACHYS (PARASYSCIA) AUGUSTÆ, sp. nov.

Worker (Fig. 1).—Length 2.5–3.5 mm. Head longer than broad, marginate and broadly excised behind and produced posteroinferiorly to form two acute, somewhat divergent angles, so that the head resembles in shape that of *Eciton schmitti* Emery. These posterior angles are continued downwards on either side as a fold which meets its fellow from the opposite side on the lower posterior surface of the head. Sides of head faintly and evenly convex; eyes entirely absent; lateral carinæ well-developed; frontal carinæ high, projecting, closely approximated, extending a short distance back between the antennal foveæ and ending on either side in a distinct tooth just in front of the rather pronounced frontal depression. Mandibles triangular, curved downwards at their tips, with

distinctly crenated edges to their blades. Antennal scape somewhat more than half the length of the head exclusive of the mandibles, rapidly incrassated towards its apex, which is provided with a deep concavity on the anterior lateral surface for the insertion of the funicle; funicle 10-jointed; first joint longer than broad, almost concealed in the concavity of the scape; joints 2–9 distinctly broader than long, gradually increasing in size distally, terminal joint very large, glandiform; constituting a club which is as long as the five preceding joints of the funicle. Thorax cylindrical, fully two and one half times as long as broad, oblong when seen from above, dorsal surface flattened, mesoëpinotal suture hardly indicated by a faint constriction. Posterior surface of epinotum abruptly declivous, carinate on either side and with an indistinct tooth above. Petiole subcuboidal, a little longer than broad, with flat dorsal surface; lower surface produced anteriorly into a large, compressed, plowshare-like tooth. Postpetiole flattened dorsally, one and a half times as long as the petiole; when seen from above its anterior margin is hardly broader than the petiole, but its posterior border is half again as wide; its lower surface is convex and projects forward a little in front of the anterior dorsal border. Stridu-

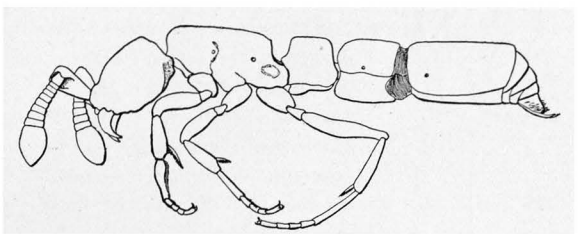

FIG. 1. *Cerapachys* (*Parasyscia*) *augustæ* n. sp. Worker.

latory organ highly developed, occupying the whole of the intersegmental membrane between the postpetiole and gaster. First gastric segment cylindrical, flattened on its dorsal surface, fully one and a half times as long as the postpetiole, slightly wider behind than in front. Remaining gastric segments very short, forming a rapidly declivous termination to the abdomen; second, third and fourth gastric segments of about equal length, tergite of the fifth segment triangular, covered with small but distinct spines on its lateral and posterior border. Sting thick, exserted. Legs rather short, all the tibiæ furnished with pectinate spurs.

Surface of body shining, except the head, which is subopaque. Mandibles finely and indistinctly striated. Head covered with large, close-set, umbilicate foveolæ except on the folds of the posterior angles which are coarsely coriaceous. Whole thorax covered with umbilicate foveolæ like those on the head. On the petiole and postpetiole the foveolæ are as large as those on the head and thorax but less densely aggregated; on the first gastric segment the foveolæ are distinctly smaller and much further apart.

Whole body covered with long, suberect, golden yellow hairs, which on the head, thorax and abdomen, arise from the umbilicate centers of the foveolæ. Hairs on the terminal antennal joint very short and dense, contrasting with the longer hairs on the scape and short joints of the funicle.

Color red, edges of mandibles, clypeus, anterior border and posterior angles of head, the funicle with the exception of the terminal joint, the articulations of the thorax, legs and abdomen and the tip of the latter blackish. Legs and terminal antennal joint slightly more yellowish than the remainder of the body.

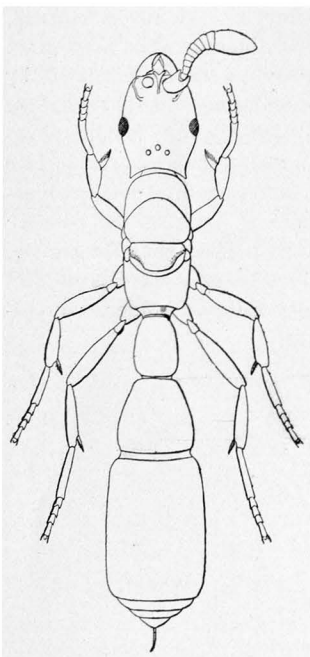

FIG. 2. *Cerapachys* (*Parasyscia*) *augustæ* n. sp. Apterous female.

Female (Fig. 2).—Length 3.75 mm.

Eyes moderately large, convex, situated in the middle of the lateral surface of the head, which is shaped like that of the worker. Ocelli well developed, not lying at the corners of an equilateral, but of an isosceles triangle with a long base. Prothorax large, scutum of mesonotum well developed, dorsally flattened, without parapsidal sutures; tegulæ large, elliptical; no paraptera between the scutum and the well-developed, flattened scutellum, metanotum narrow but distinct; epinotum large, shaped like that of the worker. On the pleural surface the mesothoracic epimerite and episternum are distinct but these elements in the metapleuræ are more obscurely separated. There is nothing to show that the thorax has ever borne wings. Petiole longer than broad, postpetiole almost twice as broad as the petiole, its posterior border nearly coëxtensive with the edge of the first gastric segment, which is both broader and longer than this segment in the worker. Terminal gastric segments and sting in all respects like those of the worker.

The sutures of the thoracic dorsum are blackened; otherwise the female is like the worker in coloration, sculpture and pilosity.

As *Cerapachys augustæ* has 11-jointed antennæ it must be placed in Emery's subgenus *Parasyscia*. Emery ('01[a] and '01[b]) has recently published a revision of the ants of the subgenus *Cerapachys* and the allied genera which he groups together as Cerapachyinæ, a supertribal division comprising the following tribes, genera and subgenera.

Tribe 1. Acanthostichii—with the single South American genus *Acanthostichus* Mayr.

Tribe 2. Cerapachyi (Africa, Asia, Australasia and Texas!).

Genus *Cerapachys* Smith (antennæ with a one-jointed club).

Subgenus *Cerapachys* (antennæ 12-jointed).

Subgenus *Parasyscia* Emery (antennæ 11-jointed).

Subgenus *Oöceræa* Roger (antennæ 10-jointed).

Subgenus *Syscia* Roger (antennæ 9-jointed; first gastric segment but little longer than the postpetiole).

Subgenus *Cysias* Emery (antennæ 9-jointed; first gastric segment much longer than the postpetiole).

Genus *Phyracaces* Emery (terminal antennal joint not forming a club — Madagascar, Africa, Borneo).

Genus *Lioponera* Mayr (2–3 terminal joints of antenna forming a club — India, Sumatra).

Genus *Sphinctomyrmex* Mayr (abdomen constricted behind each segment — Brazil).

Tribe 3. Cylindromyrmii.

Genus *Cylindromyrmex* Mayr (antennæ 12-jointed; South America).

Genus *Simopone* Forel (antennæ 11-jointed; Madagascar).

The occurrence in America of a representative of the largest and most diversified genus of the Cerapachyinæ is of some interest in view of the fact that this group is the most archaic and generalized of existing Formicidæ. It is, in fact, the group from which Emery and Forel would derive both the Dorylinæ and Ponerinæ, themselves very primitive subfamilies of ants. Inasmuch as the three remaining subfamilies (Myrmicinæ, Dolichoderinæ and Camponotinæ) are derivable from Ponerine forms, it is evident that the Cerapachyinæ must constitute a group of high phyletic significance. Emery ('95) has even gone a step further and pointed out the close resemblance of the Cerapachyi to the Mutillidæ, especially to forms like *Apterogyna*, which have a very ant-like pedicel to the abdomen and resemble the ants in many other particulars. I have copied his figure of *Apterogyna* (Fig. 5) for the sake of showing the close resemblance of this primitive Mutillid to certain species of *Cerapachys*, *e. g.*, *C. peringueyi* (Fig. 3).

While Emery and Forel agree in regarding the Cerapachyinæ as the most primitive of Formicidæ, they hold very different

opinions concerning the subfamily to which the group should be assigned. Emery ('95, '01[a]), who emphasizes morphological characters, regards the Cerapachyinæ as veritable Dorylinæ, while Forel ('99, '01), who is inclined to lay considerable stress on ethological characters, maintains that these ants are true Ponerinæ. Accordingly Emery includes the Cerapachyinæ and Dorylinæ (*sens. str.*) as two coördinate groups under the sub-

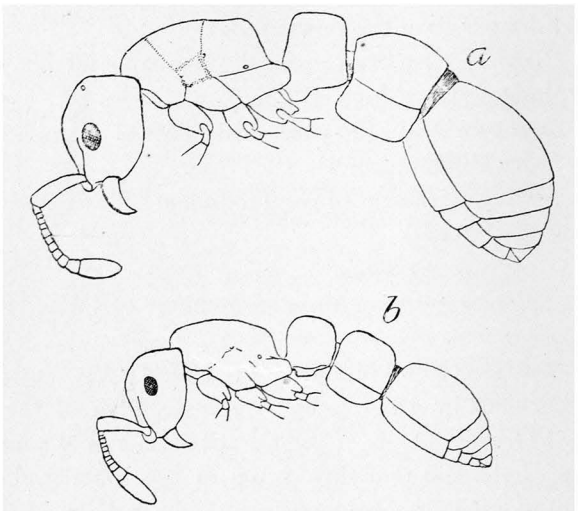

FIG. 3. *Cerapachys peringueyi* Emery. *a*, female (apterous); *b*, worker. After Emery.

family Dorylinæ, whereas Forel would regard the three tribes Acanthostichii, Cerapachyi and Cylindromyrmii as so many tribes of Ponerinæ.

Emery's position may be stated as follows: Almost nothing is known concerning the habits of the Cerapachyinæ and mere ethological inferences cannot help us in deciding the question of affinities. The female of *Acanthostichus* (see Fig. 4, *a*) is wingless and decidedly *Dichthadia*-form ("bâtie sur le type *Dichthadia* à peine mitigé"), like the females of *Dorylus* and *Eciton*. The males of the Cerapachyinæ have no cerci and have retractile copulatory organs like the Dorylinæ, whereas the cerci are present and the genitalia more or less exserted in the male Ponerinæ. In general, comparatively little value can be attached to the con-

ditions of the pedicel in the taxonomy of ants, so that we should not emphasize the Ponerine-like petiole and postpetiole of the Cerapachyinæ, especially as all sorts of pedicels are found among the different genera of this group from that of *Acanthostichus*, which is like *Amblyopone*, to that of *Oöceræa*, which recalls the conditions seen in the Myrmicinæ. The larvæ of the Cera-

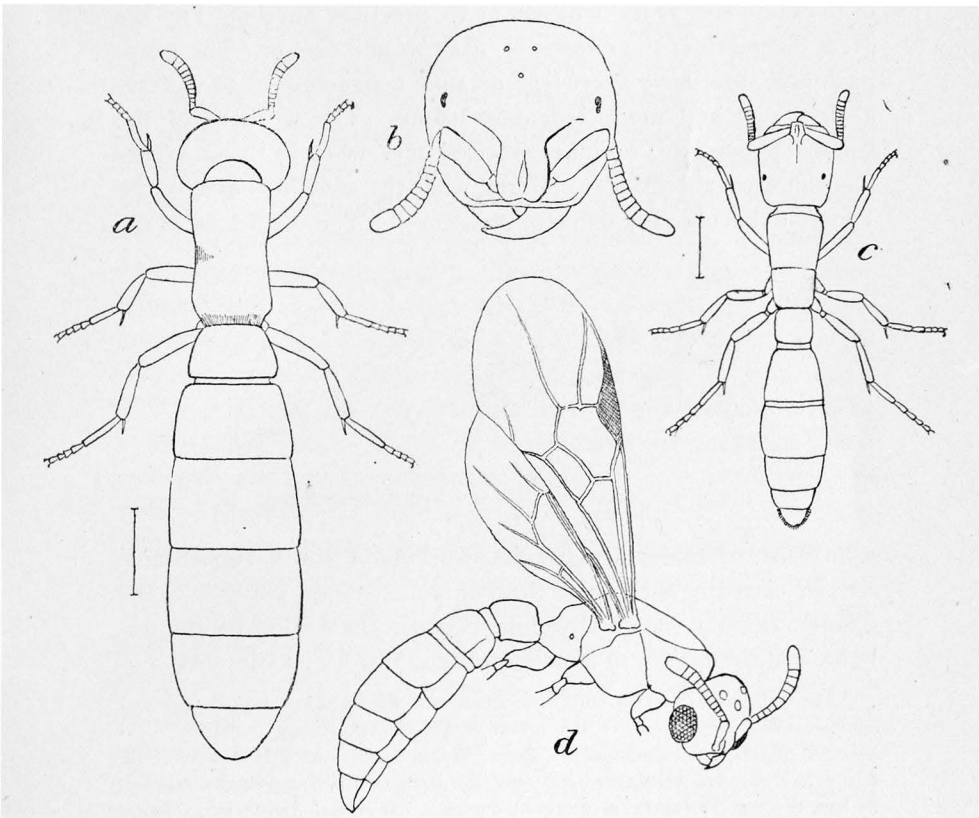

FIG. 4. *a*, *Acanthostichus quadratus*, ♀ ; *b*, head of same from front ; *c*, large worker (same magnification as *a*) ; *d*, *Acanthostichus fuscipennis*, ♂. After Emery.

pachyinæ are unknown, but as non-tuberculate larvæ, somewhat resembling those of *Eciton*, occur in some distinctively Ponerine genera (*Stigmatomma* and *Ectatomma*) it is probable that the larval characters would have little weight in solving the problem under consideration.

Forel, on the other hand, advances the following reasons for regarding the Cerapachyinæ as true Ponerinæ. While they undoubtedly exhibit traits which ally them with the Dorylinæ, their habitus is, nevertheless, decidedly Ponerine. The little that is known of their habits certainly indicates that they live in small, stationary colonies like the Ponerinæ, instead of populous, nomadic colonies like the Dorylinæ. The queens, moreover, are so nearly of the same size as the workers as to preclude anything like the great fecundity of the queens of *Dorylus* and *Eciton*. The Cerapachyinæ, too, have short legs of such a structure as to indicate a slow gait and more sedentary habits. The workers of the Cerapachyinæ have ordinary facetted eyes, whereas those of the Dorylinæ are absent or ocelliform, while the atrophied eyes of the Ponerinæ have a very different structure.[1] The conditions of the

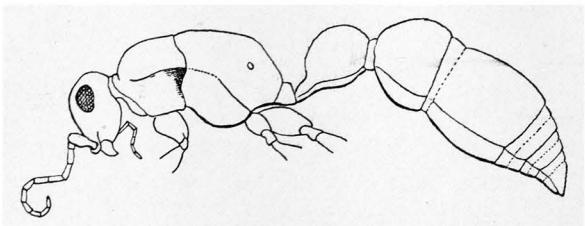

FIG. 5. *Apterogyna olivieri*. Female, after Emery.

pedicel in the males, females and workers of the Cerapachyinæ are correlated as they are in the Ponerinæ, and do not exhibit the differences seen in the Dorylinæ between the worker on the one hand and the male and female on the other. The wingless con-

[1] The distinction to which Forel calls attention is worthy of histological study. I am inclined to think, however, that it may be a distinction without a difference. I have recently sectioned a number of pupæ of *Eciton schmitti* and find that the ocelliform lateral eyes are really very much atrophied compound eyes, too much atrophied, in fact, to be at all functional as visual organs. *The retinal hypodermis, which is somewhat thickened under the convex lens, shows indistinct but unmistakable traces of ommatidia. The optic nerve is very short and not connected with the brain. It ends freely in a blunt point a short distance from the ommatidial layer. This is interesting as proving that the visual fibers must arise in the retina and grow towards the brain and not in the reverse direction from cells in that portion of the brain known as the optic ganglion.* If there is a distinction between the abortive eyes of the Dorylinæ and Ponerinæ it would seem to be that in the former subfamily the ommatidia disappear both by fusion with one another and by reduction in number, while in the latter the number of ommatidia is gradually reduced without fusion.

dition of the female Dorylinæ is not of so much value in view of the fact that some true Ponerinæ (*Leptogenys, e. g.*) have wingless ergatoid queens. The characters drawn from the male genitalia are not of themselves sufficiently important to determine the allocation of the Cerapachyinæ in a particular subfamily.

My own observations on the living *Cerapachys augustæ*, though very fragmentary, incline me to accept Forel's views and to regard the Cerapachyinæ as true Ponerinæ. There was certainly nothing in the habits of the insects to remind me of the Doryline ants notwithstanding their striking morphological resemblance, especially in the shape of the head, and the blindness of the workers, to certain species of *Eciton* (*E. schmitti* Emery, *E. sumichrasti* Norton, *E. wheeleri* Emery). The small colony, with its queen so like the workers in size and structure, and the slow movements of the insects, all very closely resemble the conditions found in many lowly organized Ponerinæ, *e. g.*, *Stigmatomma*, and I may add also, *Proceratium* and *Sysphincta* to judge from the account (*in litteris*) of my friend, Rev. P. J. Schmitt, O.S.B., who has been so fortunate as to observe living colonies of these rare ants. Moreover, the fact that specimens of Cerapachyinæ are rare in collections would seem to show that the nests of these insects are not at all populous. It is safe to say that if *C. augustæ* were like the timid *Ecitons* in its habits, it would have been impossible to find a remnant of the colony on the day following the ransacking of the nest. Morphologically the Ponerinæ are certainly a very heterogeneous assemblage of forms, but this is merely what we should expect to find in so ancient and extensive a group. The addition of the tribes of the Cerapachyinæ to this subfamily would increase but little the already existing heterogeneity, since these ants are closely related to forms like *Proceratium* and *Sysphincta* which Emery formerly regarded as Dorylinæ but has since placed with the Ponerinæ. When the Cerapachyinæ are included with the Ponerinæ, the Dorylinæ become a more homogeneous subfamily, while the Ponerinæ represent the diversified and often peculiarly specialized survivors of the ancient stock from which all the other subfamilies of ants have been descended.

It is an interesting and probably significant fact that all the

various forms of females to be met with among the Formicidæ are already foreshadowed in the small and very primitive group of the Cerapachyinæ. Though we have no knowledge of the females of several of the genera, we may recognize no less than four different female forms:

1. The female of *Acanthostichus*, which, as Emery has shown ('95), is decidedly *Dichthadia*-like, *i. e.*, unmistakably like the huge blind and wingless females of *Dorylus* and *Eciton*. This female is considerably larger than the largest workers of the colony as shown in Emery's figures of *A. quadratus* which I have reproduced in outline (Fig. 4, *a*, *b* and *c*).

2. Normal winged females like those of most genera of Formicidæ but more similar to the workers in size and structure. These females are known to occur in the genera *Lioponera*, *Cerapachys* and *Sphinctomyrmex*.

3. The female of *Cerapachys peringueyi* from South Africa (Fig. 3, *a*). According to Emery ('95) this form is wingless and not much larger than the worker (Fig. 3, *b*), which it closely resembles in structure. It may be designated as an ergatoid female and is not unlike the ergatoids occasionally found in species of *Ponera* (*P. coarctata*, *P. opaciceps*, etc.).

4. The female represented by the above described *Cerapachys augustæ* from Texas. This form is wingless but in thoracic structure resembles the winged females of the Ponerinæ in general. It is but little larger than the largest workers though possessing well-developed eyes and ocelli.

This "morphological restlessness" in the structure of the females of so small a group of genera as the Cerapachyinae is, perhaps, significant as the phyletic source to which the different female forms of all the subfamilies of ants are to be traced. We may look upon the *Dichthadia*-like queens of the Dorylinæ as a further development of the conditions exhibited by *Acanthostichus*, and the ergatoids, which crop out sporadically among the Ponerinæ and the higher subfamilies, may, perhaps, be regarded as cases of reversion to females of the type of *Cerapachys peringueyi* and the Mutillidæ (*Apterogyna*, *e. g.*). The pseudogynic forms of the more specialized ants (*Formica*, *Camponotus*) resemble the female of *C. augustæ*. Finally, the winged females

of *Lioponera*, *Sphunctomyrmex*, etc., like the normal winged females of the majority of the Ponerinæ, lead very naturally to the conditions seen in the more modified winged females of the Myrmicinæ, Dolichoderinæ and Camponotinæ.

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THE OCCURRENCE OF FORMICA CINEREA MAYR AND FORMICA RUFIBARBIS FABRICIUS IN AMERICA.[1]

WILLIAM MORTON WHEELER.

In a valuable paper published in 1886[2] Dr. Gustav Mayr recorded both *Formica cinerea* and *F. rufibarbis*, two well-known European ants, as occurring in the United States. The former was cited from California and New Mexico, the latter from Colorado, Nebraska, California, and Montana. Seven years later, when Professor Emery published his important revision of the North American Formicidæ,[3] he was so doubtful of the occurrence of these forms in the United States that he did not include them in his synoptic table. Concerning the former species he wrote : "*F. cinerea* does not occur in North America ; the form identified as such by Mayr will be described below as *F. pilicornis* n. sp." In regard to *F. rufibarbis* his statements are less positive : "For the present I am inclined to doubt whether forms belonging to the true *fusco-rufibarbis* series are actually indigenous to America. I am really unable to distinguish from rather pale and very pilose European *fusca* (*fusco-rufibarbis*) only three workers which were received from Colorado through Mr. Pergande. The precise locality of these specimens is not given."

More than a year ago Dr. Harold Heath of the Leland Stanford University sent me numerous specimens both of *F. cinerea* and *F. rufibarbis* which he had kindly collected for me near San Jose, California. The *F. rufibarbis* was compared with

[1] *Contributions from the Zoölogical Laboratory of the University of Texas*, No. 38.

[2] Die Formiciden der Vereinigten Staaten von Nordamerika, *Verhand. Zool.-Bot. Ges. Wien.*, Bd. xxxvi (1886), pp. 419–464.

[3] Beiträge zur Kenntniss der nordamerikanischen Ameisenfauna, *Zool. Jahrb.*, Abth. f. Syst., Bd. vii (1893), pp. 633–682, Taf. XXII, and Bd. viii (1894), pp. 257–360, Taf. VIII.

European specimens by Professor Emery, who reported as follows (*in litteris*): "It is the true European form, differing from our common type only in the total absence of erect hairs on the thorax. In this respect it approaches var. *glauca* Kusgky from Oriental Russia." It is possible that Dr. Mayr may have seen specimens of this same ant, but it is more probable that he had specimens of *neo-rufibarbis* Emery, a common form throughout the more western and southwestern states as far as the Pacific coast. The specimens of *cinerea* received from Dr. Heath were compared with European *cinerea* given me by Professor Emery, Professor Forel, and Dr. Mayr. The specimens from Professor Emery were collected near Bologna, Italy. They are decidedly smaller and have a darker ground color than the Californian specimens. These, however, agree very closely in their larger size and somewhat reddish coloration with the Austrian and Swiss specimens from Dr. Mayr and Professor Forel. I believe, therefore, that there can be no doubt concerning the occurrence in California of two species of Formica almost or quite identical with the European *cinerea* and *rufibarbis*. It is not so easy to decide whether one or both of these species are imported or indigenous to the American continent, but I know of no cogent reasons for accepting the former alternative. Certainly the occurrence of these species on the Pacific coast and their apparent absence from the eastern states of our Union are extremely suggestive in connection with the like geographical distribution of many other Pacific coast arthropods (Astacus, *e.g.*, many Diptera, and other insects) which are known to be more closely related to European genera and species than to those of the Atlantic states.[1]

After accustoming myself to view the distribution of the two species of Formica in this light, I was much surprised during August of the past summer to find *cinerea* very abundant in the vicinity of Rockford, Winnebago County, Ill. For several weeks of three successive summers I had collected very diligently without finding any such species in this locality. It

[1] See, *e.g.*, Osten Sacken's "Western Diptera." Cases in point are also the Californian ants of the subgenus Messor, and *Myrmica mutica* Emery, which is hardly more than a subspecies of the European *M. rubida*.

occurs most commonly, however, in such peculiar situations that there is little difficulty in understanding why it has been so long overlooked. The formicaries are so large and populous that it can hardly be regarded as an imported species unless it resembles some of the European weeds which have found the American soil so very favorable to their growth and expansion.

The following account of the localities in which I have taken *F. cinerea*, together with some notes on the structure of its formicaries, may prove to be of interest to students of insect distribution in general and of our American Formicidæ in particular. There are three of these localities some ten miles apart, in different directions and at least three to five miles from the town of Rockford, and in each of these localities, which are all open and exposed to the full heat of the sun, the nests are of a different type. August 20, I found a single nest, the first I had seen, under a small log in a meadow. This nest was not very populous and contained neither larvæ nor pupæ. It consisted of several inosculating galleries of the type usually made by species of Formica and extended down at least to a distance of 20 cm. into the black, waxy soil. The ants were timid, like the inhabitants of all small nests of Formica, and made no attempt to attack me. August 22, I found two very large nests side by side at the edge of a turnpike not far from a meadow. Each of these covered an area of somewhat more than a square meter, and each consisted of a flat mound of earth about 10 cm. high, strewn with little straws and sticks brought together by the ants. This débris concealed numerous openings from which the ants rushed forth as soon as the nest was disturbed. Excavation was difficult on account of the hardness of the soil, but it was easy to make out that the formicary consisted of a honeycomb of galleries 1–2 cm. in diameter and extended down into the soil to a depth of more than 30 cm. It was filled with worker larvæ and pupæ, together with thousands of ants, which attacked me furiously, using their jaws and formic acid batteries to good purpose. August 25, I discovered a locality where there are hundreds of *cinerea* nests. This is a meadow about a mile and a half long

and a quarter of a mile wide, surrounded by woods and corn fields. It is traversed by a cool stream, the banks of which for some distance on either side are boggy and thickly studded with large grass-covered hummocks. The *F. cinerea* have constructed their formicaries in these hummocks, which range from 30 cm. to 60 cm. in diameter at the base and from 20 cm. to 30 cm. in height. There are nests in nearly all stages of growth, but for the most part well-established and extremely populous, being, with the exception of the two nests above described, the most populous nests of Formica I have seen during the entire summer. The formicary is started in the summit of the hummock, but ultimately invades its whole earthy substance and extends to a depth of at least 30 cm. to 60 cm. into the black soil from which the hummock arises. In small or moderately large nests all the grass which originally covered the hummock remains intact and in excellent condition, but in the largest formicaries the grass on the summit is partly cut away by the ants and partly buried under the earth brought up from the galleries and the little straws, bits of twigs, leaves, etc., collected by the insects in obedience to an instinct which appears to be shared to a greater or less extent by all the species of Formica. This makes the large nests very conspicuous, although the numerous openings, all in the flattened or somewhat convex summit of the hummock, are hidden under the outermost layer of vegetable débris. The living grass forming the sides of the hummock gives the nest great stability and very efficiently protects it from being injured by the feet of the pasturing cattle. Excavation of larger nests shows that the hummocks are honeycombed throughout with a network of inosculating galleries abruptly terminating at the level of the moist, black meadow soil, into which only a very few long and more or less perpendicular galleries and chambers penetrate to a depth of 60 cm. and possibly farther.[1]

[1] During September, after this paper had been sent to the *Naturalist*, I happened on a fourth locality abounding in *cinerea* nests. This was a large meadow almost within the city limits of Rockford. It contained formicaries of all three types: under logs and stones, in the form of flat, irregular mounds and in modified hummocks.

These peculiar hummock formicaries occupy a zone on either side of the stream midway between the dryer and more boggy portions of the meadow, although a few of them reach quite to the edge of the stream and are even perforated by the burrows of frogs. The nests are so numerous as to be often within a meter's distance of one another. Along the outer edges of these zones, and mingled with the dryer *cinerea* nests, there are occasional nests of *F. subsericea* of precisely the same structure. The main zone of this species, however, lies on higher ground, where the hummock nests are replaced by true mound nests entirely constructed by the ants.[1]

There were some slight variations in size and coloration among the *F. cinerea* found in different nests in this locality, but these are all comparable to similar variations in European specimens. On the whole, the specimens from Illinois have the ground color of the head and thorax more or less reddish like the Californian and Austrian specimens. All the individuals examined have a number of hairs on the lower surface of the head. According to Emery this is the distinguishing trait of *cinerea* among all the European Formicidæ. In the United States *F. schaufussi* and *F. subpolita* and its varieties agree with *cinerea* in possessing such hairs, but they may be

[1] As Father Muckermann has shown in a recent paper (The Structure of the Nests of Some North American Species of Formica, *Psyche*, June, 1902, pp. 355–360), *F. subsericea* makes nests of at least four different styles: small flat moundlets in the grass with numerous apertures, nests in mounds capped with pieces of rock or wood, small nests beneath stones, and finally large mound nests. According to Father Muckermann the nests of the style last mentioned are neither as large nor of the same shape as those of *F. obscuripes* and *F. exsectoides*. This is true in general, but I have seen at the edges of fields in the environs of Milwaukee, whole colonies of grass-covered *subsericea* nests varying from 30 cm. to 1 in. in diameter and from 20 cm. to 30 cm. high, dimensions almost as great as those recorded by Father Muckermann for *obscuripes*. I may say in this connection that, like Father Muckermann, I do not altogether agree with Forel, who believes that the American are inferior to the European ants in mound building. As contradicting such a view, I would point to the large formicaries of *F. exsectoides* in the eastern states, to those of different varieties of *F. rufa* in different parts of the United States, to the species of Pogonomyrmex and Ischnomyrmex in the West and Southwest, and to the yellow species of Lasius (*L. aphidicola*, *claviger*, and *interjectus*) in Illinois. During the past summer I saw near Rockford a dome-shaped formicary of *L. interjectus* 1.5 meters in diameter at the base and 60 centimeters high, and I have seen many nests of this and the other yellow species of Lasius that were fully one-half to two-thirds as large.

readily distinguished by their coloration, which is never ashy or silvery gray. At first sight *F. subsericea* resembles *cinerea*, but the former never has hairs on the lower surface of the head. This character definitely separates the two forms, notwithstanding the fact that *subsericea* presents color variations in the direction of *cinerea*.[1]

The *cinerea* nests were not seen till it was too late in the year to secure the winged sexes, which, like the males and females of our other species of Formica, probably make their appearance during June and July. Even the deälated mother queens were found in but one of the smaller nests. All the nests, however, were full of worker larvæ and pupæ. The latter were generally enclosed in cocoons, but quite a number of nude pupæ were also seen in many of the nests. In this respect *cinerea* resembles the Formicidæ of the *pallide-fulva*, *fusca*, and *subpolita* groups, the worker larvæ of all of which, in contradistinction to *F. rufa* and its varieties, have a very pronounced tendency to omit spinning a cocoon just before pupation. At Rockford during the past summer many of the nests of these species contained only nude pupæ. This may have been due to the great amount of moisture in the nests, as June and July were unusually rainy. At any rate, I observed that the cocoons were relatively much more abundant during the dry weather late in August.

In its habits *F. cinerea* is very similar to the ants of the *fusca* group. It was seen in great numbers visiting the flowers in the meadow and attending great droves of Aphidæ on the willows along the stream. The walls of the galleries in some of the formicaries were tenanted by teeming colonies of the minute lestobiotic, or thief ant, *Solenopsis molesta* Say. In one *cinerea* nest I took a myrmecophilous histerid beetle (*Hetærius brunneipennis* Randall).

ROCKFORD, ILL., September 1, 1902.

[1] At Rockford I discovered two rather large nests of a form which should, perhaps, rank as a distinct variety of *F. fusca* allied to *subsericea*. The ants from these nests are smaller and more graceful in stature than the common *subsericea*, the legs and antennæ are red like those of *cinerea*, and the body is so thickly overlaid with silvery white, appressed pubescence that the black ground color is hardly visible. This form may be called *Formica fusca* var. *argentata* var. nov.

EREBOMYRMA, A NEW GENUS OF HYPOGÆIC ANTS FROM TEXAS.

WILLIAM MORTON WHEELER.

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EREBOMYRMA, A NEW GENUS OF HYPOGÆIC ANTS FROM TEXAS.[1]

WILLIAM MORTON WHEELER.

The occurrence of a new genus of ants in a country so long known to entomologists as the United States is a matter of surprise when we reflect that the Formicidæ constitute a much smaller family and one much better understood taxonomically than many of those that go to make up the great order of the Hymenoptera, and that, notwithstanding the zeal of collectors, new ant genera are rarely brought to light at the present time even in the most remote and inaccessible regions of the globe.

Early in October Mr. W. H. Long, Jr., kindly sent me from Denton, near the northern boundary of Texas, a number of ants, which, had only the minute yellow workers been present, I should have regarded at first sight as specimens of our common *Solenopsis molesta* Say. But the large males and still larger females in the same vial were so unlike any ants I had ever seen that I undertook a more careful examination of the workers and found them to differ not only from any of the known American genera but also from the Old World genera as well.

In response to a request for data concerning the capture of the specimens, Mr. Long sent me the following: "I have seen this species only once. That was early one morning (I believe it was September 21) after a warm rain the night before. My attention was attracted by an old hen greedily devouring the winged forms as they issued from a small hole in a clear, open space in my back yard. There were no rocks, heaps of earth or surface indications of a nest of any kind. Most of the males and females flew away at once, but here and there I saw a few couples mating near the nest. The diminutive workers fondled and clung to the sexual individuals till the latter escaped into the air. There were many more males than females."

The following is a description of the new genus and species which I take pleasure in dedicating to Mr. Long, as a very slight

[1] Contributions from the Zoölogical Laboratory of the University of Texas, No. 45.

acknowledgment of his aid in working out the distribution of our Texan Formicidæ.

EREBOMYRMA gen. nov.[1]

Worker.—Diminutive and monomorphic. Integument yellow, almost without pigment.

Head rather large, suboblong, its posterior border nearly straight, its lateral borders slightly convex. Mandibles rather long, with oblique, 4-toothed blades. Clypeus short, with concave median surface and a pair of teeth on its anterior border. These project downwards rather than forwards and are continued upwards as two distinct ridges on the clypeus. Eyes about one third the length of the head from the insertion of the mandibles, very small, consisting of a single indistinct lens and a few granules of pigment. Ocelli absent. Frontal carinæ short, somewhat further apart than in *Solenopsis*, forming on either side a small lappet covering the insertion of the antenna and then suddenly diverging posteriorly and ending abruptly. Frontal area small, triangular, indistinct. Frontal groove obsolete. Antennal foveæ well-developed. Antennæ 11-jointed; scape of the usual form, first to eighth joint of funiculus together hardly as long as the distinctly 2-jointed club; first funicular joint as long as the four succeeding joints taken together and distinctly broader; joints 2–7 broader than long; eighth joint about as long as broad; basal joint of club about two fifths as long as the terminal joint. Labial palpi 2-jointed, maxillary palpi 1-jointed. Thorax considerably narrower than the head, prothorax with rounded humeri, somewhat flattened above and not separated by a distinct suture from the mesothorax; meso- and metathorax of nearly the same width and distinctly narrower than the prothorax; meso- and epinotum separated by a deep constriction, epinotum armed on either side with a flattened tooth which is hardly longer than broad at its base and continued downwards and backwards as a distinct lamella; dorsal and declivous surfaces of epinotum of about equal length. Petiole in profile much larger than the postpetiole; with a high, rounded node and a slender median tooth on its anterior ventral surface. Seen from above the petiole is more than twice as long as broad, widest behind the middle, slender and subpedunculate in front. Postpetiole seen from above broader behind than in front, campanulate, its posterior edge about twice as broad as the petiole; in profile its dorsal and ventral surfaces are moderately convex. Gaster rather small, narrower than the head, elongate elliptical and somewhat flattened dorsoventrally; anal opening distinctly on the ventral surface, in front of the apex of the gaster. Sting small and apparently vestigial. Legs robust, the femora and tibiæ incrassated, the former towards

[1] From Ἔρεβος, Erebos, and μύρμος, ant; an allusion to the subterranean habits and the gloomy coloring of the males and females.

the middle, the latter towards their distal ends. Middle and hind tibiæ without spurs. Claws simple.

Female.—Very large as compared with the worker; deeply colored.

Head subquadrate, convex above; posterior border slightly concave, sides nearly parallel, posterior angles rounded. Eyes and ocelli rather small, the former round and placed in front of the middle of the head; median ocellus depressed. Mandibles convex, with oblique 6-toothed blades. clypeus short and broad, somewhat flattened in the middle, the teeth and their longitudinal ridges on the anterior border obsolescent. Frontal carinæ short, rather evenly diverging posteriorly, in front forming a slight fold over the antennal insertion. Frontal area triangular, longer than wide, continued back as a rather deep frontal groove as far as the anterior ocellus, just in front of which it becomes somewhat broader. Antennæ 11-jointed; scape very short, not reaching the posterior orbit, distinctly incrassated. Funiculus short and compact, with an indistinctly 3-jointed club, the penultimate joint of which is more than half as long as the terminal joint, the antepenultimate nearly half as long as the penultimate and but little thicker than the basal joints of the funiculus. Thorax of the usual structure; epinotum with a blunt tooth on either side continued downwards to the posterior edge as a low, rounded ridge. Petiole seen from above not broader than long, its base very shortly pedunculate; anterior declivity long and very convex, at the summit passing abruptly into the very concave posterior declivity, so that the summit of the node forms a trenchant transverse ridge; lateral surface on either side longitudinally carinate, ventral surface somewhat compressed and produced anteriorly into an acute median tooth like that of the worker. Postpetiole in profile but little smaller than the petiole, and when seen from above but little broader; its anterior border straight, its anterior angles rounded, its posterior border semicircular and fitting back into a deep semicircular excision of the first gastric segment; sides of the postpetiole carinate. Gaster large, fully two and one half times as long as broad and but little broader that high. Anal opening and sting inconspicuous, decidedly ventral in position. Legs rather short and weak, the terminal joints of the tarsi more tapering than in the worker. Wings of the usual form, long and well developed. Venation much like that of *Solenopsis*, with well-developed radial, cubital and discoidal cell; the last larger than in *Solenopsis* and its opposite sides much more nearly parallel; external branch of cubital vein turning forwards and meeting the costa some distance in front of the tip of the wing; median vein and internal branch of cubital reaching very nearly to the margin of the wing; posterior cross-vein short and perpendicular to the median and internal veins. Pterostigma well developed.

Male.—Much larger than the worker but smaller than the female, deeply colored.

Head in proportion to the thorax much larger than in *Solenopsis*; excluding the eyes distinctly broader than long, rounded behind. Eyes and

ocelli very large and prominent. Cheeks much longer than in *Solenopsis*. Mandibles well developed, overlapping, with very oblique 4-toothed blades. Clypeus about as long as broad, very conspicuously convex, hemispherical, its anterior border somewhat truncated, without teeth. There is a small, round, deep pit on either side near the base of the clypeus. Frontal groove and carinæ hardly developed. Antennæ rather short, 13-jointed, of nearly uniform thickness throughout except for the scape and second joint, the former being somewhat thicker, the latter somewhat narrower than the other joints; scape and joints 3–13 cylindrical, more than twice as long as broad; second joint about half as long as any of the succeeding joints, of the usual shape and not globose as in *Solenopsis*. Thorax large, with unarmed epinotum or in some specimens with only blunt protuberances in the place of the worker armature. Petiole hardly pedunculate, in profile a little longer than high, its lower surface without a tooth, its node moderate, with the anterior declivity longer and more uniformly sloping than the posterior. Postpetiole shorter than the petiole but twice as broad, campanulate, broadly open behind and conspicuously overlapping the first gastric segment especially on the dorsal side. Gaster elongate-elliptical, rather pointed posteriorly, distinctly compressed dorsoventrally. Genitalia more or less, in some specimens considerably, exserted. Legs rather long and slender. Wings like those of the female.

EREBOMYRMA LONGII sp. nov.

Worker.—(Figs. 1 and 2.) Length 1.5–2.25 mm.

Varying from amber yellow throughout to pale brown; only the teeth and edges of the mandibles dark brown or black.

Mandibles shining, somewhat striated, with coarse piligerous punctures. Clypeus in the middle between the longitudinal ridges smooth and shining, sides more opaque and rugose. Anterior angles of head and outer portions of antennal foveæ subopaque, traversed by regular and parallel longitudinal rugæ. Frontal area and upper surface of head smooth and shining, covered with rather coarse piligerous punctures. There are a few longitudinal rugæ extending back from the frontal carinæ half way to the posterior border of the head. Sides and ventral surface of head opaque, reticulate-rugose. Antennal scape reaching half way to the posterior angle of the head, slender at the base and somewhat thickened towards the apex. Pro- and mesonotum smooth and shining, with indistinct piligerous punctures. Mesopleuræ and epinotum coarsely and evenly reticulate-rugose, even to the tips of the teeth and the space included between them. Petiole similarly, but somewhat less coarsely, reticulate-rugose, except on the upper surface of the node which is smooth and shining. Postpetiole, gaster, legs and antennæ smooth and shining.

Whole body covered with rather long and abundant pale yellow hairs which on the mandibles, head and thorax arise from the punctures. These hairs are longest on the clypeus and posterior segments of the gaster.

They are conspicuous on the legs and antennæ, especially on the scape and all the joints of the funiculus except the club. On the upper surface

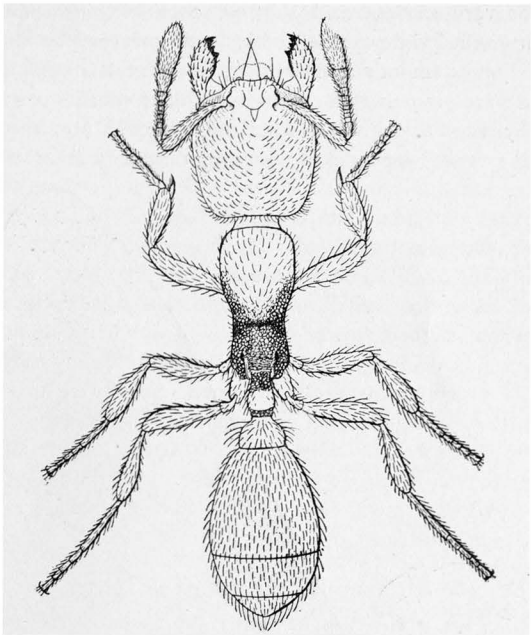

FIG. 1. *Erebomyrma Longii* sp. nov. *Worker.* (Dorsal view.)

of the head the hairs are somewhat more appressed and directed from either side towards the median line which is rather bare. There is no pubescence.

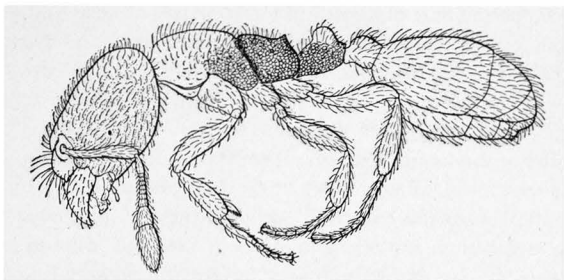

FIG. 2, *Erebomyrma Longii* sp. nov. *Worker.* (Lateral view.)

Female.—(Figs. 3 and 4.) Length 8–8.5 mm.

Black; abdomen, antennæ and legs blood-red; wing insertions, metanotum, lower portions of epinotum, petiole, and postpetiole, the frontal carinæ and lateral portions of clypeus suffused with red; mandibles black, with a broad red band across their apical third; bases of coxæ and middle

portions of femora black; wings black, except their apical third which is hyaline; nervures and stigma black.

Mandibles very smooth and shining, covered with coarse piligerous punctures irregularly interspersed with much smaller punctures. Middle portion of clypeus smooth and shining, finely and irregularly punctate; outer portions grossly punctate except laterally where they are very coarsely longitudinally rugose. Frontal area subopaque. Head opaque, very coarsely and evenly longitudinally rugose, the spaces between the rugæ

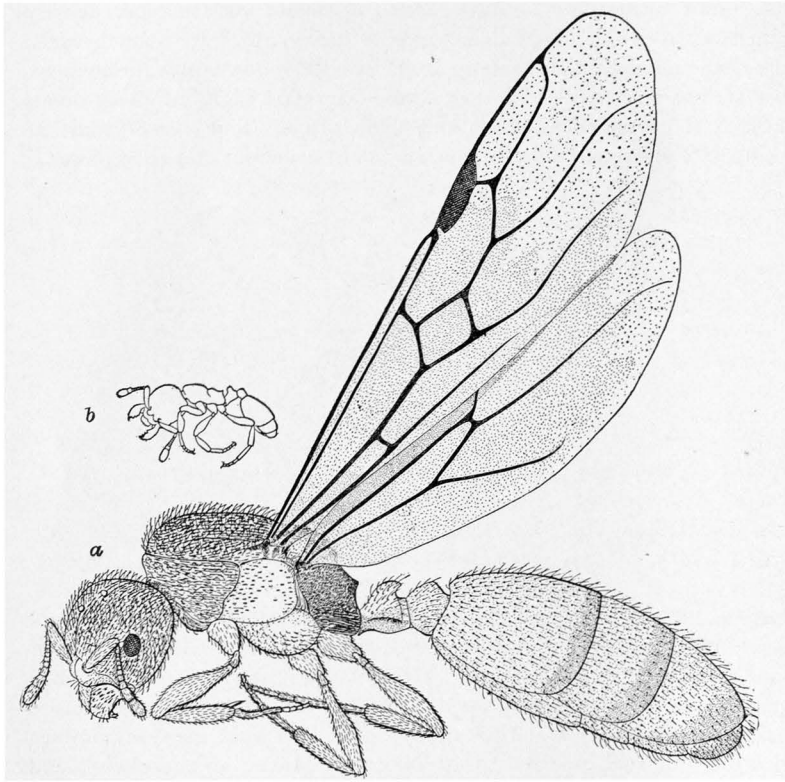

FIG. 3. *a. Erebomyrma Longii* sp. nov. Female. *b.* Worker drawn under the same magnification.

being faintly and confluently foveolate. In the antennal foveæ the rugæ are beautifully concentric, on the front and sides of the head they are longitudinal, but in the region of the ocelli diverge and separate into two systems, passing to the posterior angles of the head. On the occiput the space between the diverging series is filled by a transverse series of rugæ. Antennal scape rugose and very coarsely punctate, or foveolate. Thorax largely opaque, pronotum and neck more densely reticulate and longitudi-

nally rugose than the head ; mesonotum subopaque, with a smooth, shining band down the middle and along each parapsidal furrow ; with the exception of these regions the whole surface is covered with large elongate-elliptical foveolæ, the spaces between which are more finely punctate and raised into indistinct longitudinal rugæ. Paraptera and scutellum shining, with transversely elliptical foveolæ which are almost absent in the middle of the latter sclerite. Mesopleuræ shining and foveolate like the mesonotum. Surface of metanotum irregularly foveolate and in addition covered with fine, more or less longitudinal rugæ. Epinotum very opaque, densely punctate above and longitudinally rugose below. In the region between the teeth and the ridges running backwards and downwards from them, the surface is crossed by rather coarse transverse rugæ. Convex dorsal surface of petiole very smooth and shining, finely and sparsely punctate and with a few round foveolæ which are most numerous along the posterior

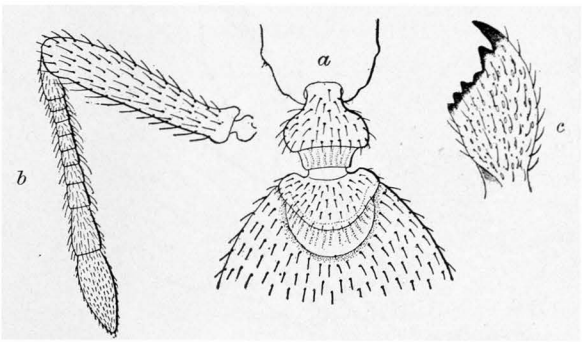

FIG. 4. *Erebomyrma Longii* sp. nov. Female. *a*. pedicel and base of gaster. (dorsal view.) *b*. antenna; *c*. mandible.

edge and the sides of the node ; concave posterior dorsal declivity and the whole ventral surface of the petiole opaque, very finely and densely punctate, the former in addition with indistinct rugæ radiating from the posterior edge of the segment. Postpetiole above in the middle shining, with several round foveolæ, which on the sides become prolonged backwards so that the surface has a somewhat grooved appearance ; lower surface opaque and densely punctate like the lower surface of the petiole. Gaster shining, the segments smooth and very finely and sparsely punctate at their bases but more opaque and evenly reticulate along their distal borders. In addition to this sculpturing there is a small cluster of impressed reticulations around the insertion of each hair. Legs coarsely punctate-foveolate.

Body, except the epinotum, covered with tawny hairs which are relatively shorter than in the worker. On the head, thorax and femora the hairs are erect, on the petiole, postpetiole and gaster suberect, on the antennæ, tibiæ and tarsi shorter and more appressed. Wings covered with minute black hairs.

Male.—(Fig. 5.) Length 5–5.5 mm.

Black; venter and posterior margins of gastric segments fuscous; antennæ whitish but appearing somewhat infuscated on account of a covering of very short black hairs; antennal scape black, second joint paler than the succeeding joints. Mandibles reddish, black only at their bases. Tarsi infuscated from the tip of the first joint. Wings blackened, apical third hyaline; veins and stigma black.

Mandibles longitudinally striated, especially at the base; smooth and shining towards their tips. Clypeus shining in the middle, irregularly and coarsely rugose at its lateral and posterior edges. Head subopaque, with several systems of rather indistinct, parallel rugæ with smooth interrugal spaces; one system runs transversely just behind the clypeus, another on either side from the frontal carina obliquely to the anterior ocellus, where it meets the corresponding series from the other side; another system runs transversely between the two posterior ocelli, while still another is continued downwards from each of these ocelli to the sides and back of the head.

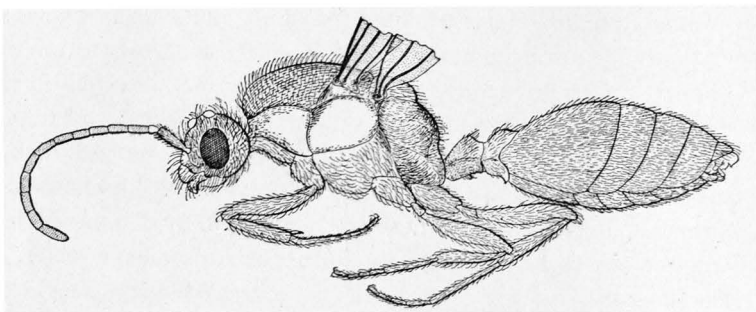

FIG. 5. *Erebomyrma Longii* sp, nov. Male.

Mesonotum subopaque, remainder of thorax smooth and shining except the neck and mesopleuræ which are opaque. Mesonotum with a smooth median band only on its anterior half, the remaining surface more densely covered with elliptical foveolæ than in the female. Metanotum and posterior portion of scutellum with fine parallel transverse rugæ. Mesopleuræ and sides of pronotum sparsely foveolate. Metapleuræ longitudinally rugose. Epinotum almost impunctate. Petiole and postpetiole somewhat roughened and subopaque, node of former smooth and shining, as is also the gaster. The sculpture of the gaster is like that of the female but more indistinct.

Body covered with rather dense, yellowish-gray hairs, which are suberect on the head, thorax and abdomen, but appressed on the legs. There are a few hairs on the shining surface of the epinotum and on the petiolar node. On the antennæ the hairs are microscopic, except on the scape where they are dense and rather conspicuous. Wings covered with minute black hairs.

Described from numerous workers and males and four females from Denton, Denton County, north Texas.

The genus *Erebomyrma* is to be placed in the Myrmicinæ tribe Solenopsidii, which is known to embrace the following genera: *Solenopsis* Westwood (cosmopolitan); *Diplomorium* Mayr (South Africa); *Aëromyrma* Forel (Madagascar); *Oligomyrmex* Mayr (India, Australia); *Carebara* Smith (Africa, Australasia); *Tranopelta* Mayr (South America); *Lophomyrmex* Emery (India); and *Pheidologeton* Smith (India and Australasia).[1] With the exception of the first and last, these genera are represented each by only one or a few species, and in some cases the sexual forms are imperfectly known. Of *Tranopelta* the workers are unknown, unless the workers from Paraguay mentioned by Mayr (Suedafrikanische Formiciden, 1901, p. 17) as having a distinctly 3-jointed antennal club, 3-jointed maxillary palpi and very small eyes, belong to this genus. In view of these facts a future revision of the tribe Solenopsidii may lead to modifications in the definition of the genera including the one described in this paper. The genera *Aëromyrma*, *Oligomyrmex*, *Pheidologeton* and certain species of *Solenopsis* are characterized by having highly dimorphic workers. In many cases these are connected by a more or less complete series of intermediate forms in the same nest (*e. g.*, *Pheidologeton*, *Solenopsis geminata*). *Erebomyrma* agrees with *Diplomorium*, *Carebara* and most species of *Solenopsis* in having workers of one caste only, and these are extremely diminutive as compared with the males and especially the females. *Erebomyrma* is evidently most closely related to *Solenopsis*, *Diplomorium* and *Aëromyrma*, but differs from the two former in having the epinotum armed and from the latter in having 11- instead of 10-jointed antennæ, and in the absence of any dimorphism in the workers. The latter character is variable, however, since in one genus (*Solenopsis*) it is absent in most of the species, though highly developed in others. The female of *Erebomyrma* is colored and sculptured much like the female of the African *Carebara vidua* Smith, while the male seems to have many points in common with the male of *Tranopelta*. It is probable that *Erebomyrma*

[1] The genus *Melissotarsus* Emery, formerly supposed to belong to this group of genera, is now placed among the Ponerinæ by Emery.

is not a monotypic genus but comprises also several South American species. At least Professor Emery writes me that he has in his collection two species which seem to belong to the new genus. Both of these are represented by female specimens only. One is from Bolivia, the other from Rio de Janeiro.

Comparatively little is known concerning the ethology of the Solenopsidii apart from the genus *Solenopsis*, which has many representatives in Europe and North America. The majority of the species belonging to the tribe, if we except *Pheidologeton* and the larger forms of *Solenopsis*, like *S. geminata*, appear to have certain common ethological traits of more than usual interest. These characters, which were first appreciated by Forel, and constitute one of the many fine discoveries of that able naturalist, are the following:

1. The males and especially the females of the smaller species of *Solenopsis*, the species of *Aëromyrma*, *Carebara*, *Oligomyrmex*, and presumably also of *Tranopelta*, are of very large size compared with the workers. The same is also true of *Pheidologeton* and the polymorphic species of *Solenopsis* when the sexual forms are compared with the most diminutive caste of workers. The relative dimensions of the queens differ, however, considerably in the different genera. Thus in our common North American *Solenopsis molesta* the workers measure 1.5 mm. in length, the females 4.5–5 mm.; while in *Carebara vidua* the worker is hardly larger than that of *S. molesta* (1.5–2 mm.) whereas the female is of gigantic dimensions (23 mm.). The dimensions of *Erebomyrma Longii* lie between these extremes, though much nearer to those of *S. molesta*. The worker is 1.5–2.25 mm. long, the female 8–8.5 mm. If we cube the dimensions in these three species and make due allowance for the fact that the body of the female ant is in each case proportionally much thicker than that of the worker, we have the following roughly approximate ratios between the volumes of the workers and females:

Solenopsis molesta,	1 : 20.
Erebomyrma Longii,	1 : 150
Carebara vidua,	1 : 2000.

These are rather extraordinary dimensions for queens as com-

pared with workers, especially when we reflect that they represent the sterile and fertile extremes of the same sex.[1]

2. The workers of the species in question all have a pale, etiolated appearance, being uniformly yellow or light brown in color, while the huge males and females are deeply and often conspicuously colored. This is noticeably the case with *Carebara* and *Erebomyrma*.

3. The eyes of the workers are vestigial or quite absent (*Carebara*), in marked contrast with the well-developed eyes and ocelli of the males and females.

4. As we should naturally infer from the characters enumerated under 2 and 3, these ants are hypogæic or subterranean, *i. e.*, rarely or never coming to the surface except during the nuptial flight of the deeply colored sexual forms.

5. It is clear that the diminutive workers must be able to obtain large quantities of food, or they could never raise so many and such enormous males and females. From this, again, we may infer that the species prey on other ants or termites, and this inference is supported by observation in all cases where it has been possible to study these ants in their nests. The European *Solenopsis fugax*, the North African *S. latro*, the North American *S. molesta* and *S. texana*, and probably many other small species of the genus, live in the nests of larger ants belonging to different genera and species (*Formica*, *Aphœnogaster*, etc.). Here they inhabit small chambers in the walls separating the galleries of the larger species and, escaping notice, probably on account of their minute size and neutral nest-odor, prey upon the helpless and well-fed larvæ and pupæ of their hosts. This mode of life has been recently called "*lestobiosis*" by Forel, who has directed attention to similar habits in *Aëromyrma* and *Carebara*. Sikora found *Aëromyrma Nosindambo* Forel, of Madagascar, as a regular inhabitant in the earthen nests of termites, and Haviland

[1] Other cases comparable to the extreme disproportions of the female and worker *Carebara* are certainly rare but they occur nevertheless in *Pheidologeton* and in *Atta* (*s. str.*). The minimum workers of the Texan *Atta fervens* Say are barely 2 mm. long, whereas the queens measure fully 17 mm. Among some specimens of the Bengalese *Pheidologeton ocellifer* Smith given me by Professor Forel, I find diminutive workers only 2.25 mm. long and a queen of 16 mm. The relative differences in volume in these cases can be approximately computed without difficulty.

found *Carebara vidua* of South Africa also living in lestobiosis in the clay nests of termites (*Termes natalensis*). A consideration of these facts and the taxonomic affinities of *Erebomyrma Longii* led me to surmise that this species too must be lestobiotic, in all probability not with other ants but with some of our Texan termites. That the species is hypogæic would seem to be perfectly clear from Mr. Long's statements quoted in the opening paragraphs of this paper. A second letter, in response to a request urging him to search for termite nests on the spot where he found the *Erebomyrma*, tends to confirm my suspicions of its lestobiotic habits. Mr. Long says: "There seems to be a great number of termites in this vicinity, as I found the sexual forms issuing in great numbers from many holes in my back yard, just like the ants of the new genus which I sent you. Several of these holes were very close to the spot where the ants were captured." During the coming year Mr. Long will endeavor to obtain more definite data concerning the habits of the interesting ant which he has brought to my notice.

AUSTIN, TEXAS,
November 29, 1902.

DIMORPHIC QUEENS IN AN AMERICAN ANT (LASIUS LATIPES WALSH.)

W. M. WHEELER AND J. F. MCCLENDON.

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DIMORPHIC QUEENS IN AN AMERICAN ANT (LASIUS LATIPES WALSH).[1]

W. M. WHEELER AND J. F. McCLENDON.

On the afternoon of September 17 of the current year the senior author had occasion to witness the nuptial flights of several species of *Lasius* in an open wood near Rockford, Illinois. These flights occurred almost simultaneously from mound nests of *Lasius niger* var. *americanus*, *L. claviger* and *L. latipes*. The first species is ubiquitous in all open country in the Northern States, especially where the soil is sandy or loamy. Owing to the dingy color of the workers, males and females, and the relatively small size of the colonies, the nuptial flight of this species offers nothing of special interest or beauty. It is quite otherwise with some of the yellow *Lasius*, of which at least eight species are known to occur in the United States, namely: *L. aphidicola* Walsh, *speculiventris* Emery, *brevicornis* Emery, *myops* Forel, *interjectus* Mayr, *claviger* Roger, *latipes* Walsh, and *Murphyi* Forel. The last is known only from North Carolina and Colorado. *L. interjectus*, *aphidicola*, *claviger* and *latipes* build large mound nests, often a foot or more in diameter and several inches high, either in open grassy places or about the bases of rotting stumps. These mounds are shot through with living grass and covered with little openings for the ingress and egress of the ants. *L. latipes* in some localities prefers to build its nests under rather large stones. This is the case at Colebrook, Connecticut, for example. Unlike *L. niger* and its varieties the yellow species of the genus appear to be nocturnal in their habits and *L. myops* largely subterranean. At any rate the workers of these various species are not seen to leave the nests in the day-time except during the nuptial flight of the males and virgin females.

[1] Contributions from the Zoölogical Laboratory of the University of Texas. No. 46.

This flight, especially in the case of *L. latipes*, presents a beautiful spectacle. At the moment when the great swarming

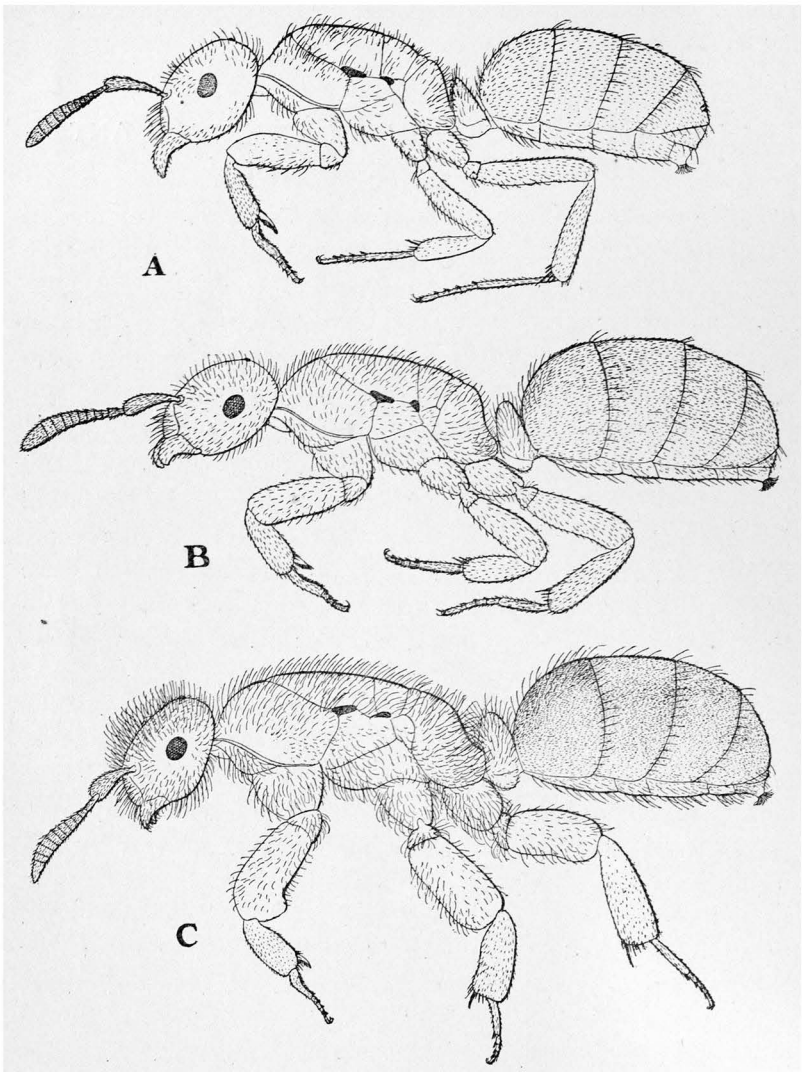


FIG. 1. *A*, *Lasius claviger* Roger ♀; *B*, *Lasius latipes* Walsh α-♀; *C*, *L. latipes* β-♀. The wings are omitted.

impulse seizes the colony, the shining amber-yellow workers, together with the hosts of sable males and large tawny-red females, break in a flood from the main openings of the nest.

The winged forms hasten up the slender grass-blades on which they rock for a few moments, while filling their tracheæ with the pure air of the upper world, then one by one spread their glittering wings and soar into the air like sparks rising from a fire.

While watching a colony during this interesting culmination of its annual development, the senior author noticed females of two different kinds issuing in numbers from the same openings of the grass-covered mound. The majority of these females were the remarkably pilose individuals, of a rich fulvous red, with extremely broad and flat legs and abnormally short, feeble tarsi, which have always been regarded as the true females of *L. latipes*. Among these, however, there were several hundred females which were perceptibly smaller, of a deep brown color, much less pilose, with only moderately broadened and compressed legs and with much longer tarsi. Both forms mingled with the workers and males and took flight together within the same half hour. Although the unusual character of this observation was fully appreciated at the time, circumstances made it impossible to excavate the nest and search its penetralia for the mothers of these very different virgin females. It seemed best to leave the nest for careful study at some future time and to collect a large number of the workers, males and females at the surface.

In this paper we will designate as the β-female the highly aberrant form (Fig. 1, *C*) with the excessively flattened legs, *i. e.*, the form which has hitherto passed as the true and only female of *latipes;* the other (Fig. 1, *B*) we will call the α-female. These designations will suffice for present purposes and will leave the facts uncolored by the conjectural meaning of this singular dimorphism.

A few days after the above recorded observations were made the senior author returned to Texas, and soon afterwards, with the aid of the junior author, undertook an examination of all the material of *L. latipes* collected during three consecutive summers in three different localities. This was easily possible because the specimens from different nests had been kept by themselves in separate vials of alcohol. There were, in all, collections from ten separate nests, as recorded with the date of capture and the personnel of each colony in the following table:

Nest No. 1. Woods Hole, Mass., Aug., 1900. ☿, ♂, β-♀.

Nest No. 2. Woods Hole, Mass., Aug., 1900. ☿, β-♀.

Nest No. 3. Colebrook, Conn., Aug. 19, 1901. ☿, β-☿.
Nest No. 4. Colebrook, Conn., July 21, 1901. ☿, β-☿.
Nest No. 5. Colebrook, Conn., Aug., 1901. ☿, ♂, α-☿, β-☿.
Nest No. 6. Colebrook, Conn., Aug. 12, 1901. ☿, ♂, α-☿.
Nest No. 7. Rockford, Ill., July 6, 1902. ☿.
Nest No. 8. Rockford, Ill., Aug. 15, 1902. ☿, ♂.
Nest No. 9. Rockford, Ill., Aug. 20, 1902. ☿, ♂.
Nest No. 10. Rockford, Ill., Sept. 17, 1902. ☿, ♂, α-☿, β-☿.

Nest No. 1 was collected by Miss Adele M. Fielde. No. 2 was an artificial nest seen in one of the laboratories at Woods Hole. It contained many workers and a single deälated female of the β-type. Of the ten nests in the table it will be seen that three contained workers only, or workers and males. These may be disregarded as having no bearing on the subject under consideration. Of the seven nests containing females, four contained β-females only; two contained both α- and β-females, and one contained α-females only. Thus it is seen that the α-female, which has not been observed hitherto, occurred in three out of seven nests, and in two very widely separated localities. This is significant in view of the fact that *L. latipes* is not nearly so common a species as *L. claviger*, *interjectus*, *myops* or *aphidicola*.

Examination of a considerable number of females of both types failed to disclose any forms intermediate in structure or pilosity. In nest No. 5, however, all the β-females had the same deep brown color as the α-females of the same nest. There were often considerable individual variations in the venation of the wings, but these variations occurred in both types indiscriminately. The types were not connected by intermediate forms and were indistinguishable from each other by any characters in the shape, color, or venation of the wings, so that these organs could be omitted in the figures and in the comparative statements to be given below.

A study of the descriptions of *L. latipes* by previous writers shows very clearly that the β-female has played a very important rôle in the recognition of the species, because it differs so markedly in structure and pilosity from the females of any of the known members of the genus. The original description by Walsh ('62, p. 311) is so brief and inadequate that it would have been con-

	L. claviger. ♀*	L. latipes. α-♀	L. latipes. β-♀
Length of thorax	2,517	3,390	3,487
Length of gaster	3,055	3,681	3,487
Length of petiole	285	303	392
Height of petiole	872	926	943
Length of antennal scape	926	890	854
Apical breadth of antennal scape	178	230	267
Length of funiculus	1,566	1,513	1,370
Breadth of funiculus	214	231	249
Length of fore femur	1,264	1,264	1,335
Length of middle femur	1.193	1,175	1,282
Length of hind femur	1,356	1,388	1,460
Breadth of fore femur	427	498	659
Breadth of middle femur	303	427	605
Breadth of hind femur	356	463	623
Length of fore tibia	1,068	1,015	979
Length of middle tibia	1,015	1,050	1,086
Length of hind tibia	1,513	1,513	1,442
Breadth of fore tibia	320	356	445
Breadth of middle tibia	267	338	427
Breadth of hind tibia	267	356	481
Length of fore spur (strigil)	338	320	231
Length of middle spur	231	249	249
Length of hind spur	267	267	267
Length of whole fore tarsus	1,015	905	729
Length of first fore tarsal joint	570	516	374
Length of second fore tarsal joint	89	89	89
Length of third fore tarsal joint	89	71	71
Length of fourth fore tarsal joint	89	71	53
Length of fifth fore tarsal joint	178	160	142
Length of whole middle tarsus	1,175	961	818
Length of first middle tarsal joint	605	534	409
Length of second middle tarsal joint	125	107	89
Length of third middle tarsal joint	107	89	89
Length of fourth middle tarsal joint	107	89	71
Length of fifth middle tarsal joint	231	142	160
Length of whole hind tarsus	1,691	1,406	997
Length of first hind tarsal joint	979	783	570
Length of second hind tarsal joint	196	160	107
Length of third hind tarsal joint	142	125	89
Length of fourth hind tarsal joint	107	89	71
Length of fifth hind tarsal joint	267	249	160

signed to the limbo of useless specific diagnoses except for the mention of the extraordinarily flattened legs in the female, a character which is, moreover, emphasized in the specific name. Walsh had only two specimens of the β-female. The locality of the types is not given, but was probably Rock Island, Illinois. It was the flattening of the legs of *L. claviger*, a trait still more pronounced in *latipes* and visible also in *interjectus* and the more recently discovered *Murphyi* that led Mayr ('62, p. 51) to separate these forms as the genus *Acanthomyops*. Later he reduced

* The dimensions are in micra.

this genus to subgeneric rank under *Lasius*, where it is still used to include those species which have 3- instead of 6-jointed maxillary palpi. Mayr redescribed ('66, p. 889) the β-female from a defective specimen from Wisconsin, and says that he was at first tempted to place it in a new genus on account of its remarkable appearance. That he refrained from doing this is evidence of his keen taxonomic insight. Later writers, like Emery ('93, p. 638), have included the β-female in the table of *Lasius* species as distinguishable from all other females by having "the hind tarsus shorter than the much flattened tibia." The discovery of the α-female, which has the hind tarsus longer and the tibia much less dilated, makes it more difficult to recognize the species. This has induced us to make a closer study of *L. latipes* and of the allied *claviger* in all the sexual phases.

Comparison shows that the α-female is almost intermediate between the β-female and the female of *claviger*. This is clearly shown in the figures, in the table of measurements on p. 153, drawn up by the junior author, and in the two-column statement of the principal differences between the α- and β-females, as compared with the female of *L. claviger* as a standard:

α-female of Lasius latipes.	**β-female of Lasius latipes.**
1. Dark brown, like *L. claviger* ♀.	1. Fulvous red, in one nest (No. 5) dark brown like the α-female.
2. A little more pilose and pubescent than *L. claviger* ♀.	2. Much more pilose and pubescent.
3. A little larger.	3. Considerably larger and longer.
4. Thorax longer in proportion to the gaster.	4. Thorax much longer in proportion to the gaster.
5. Mesonotum and scutellum as in *claviger* ♀.	5. Mesonotum and scutellum flatter.
6. Petiole thicker, higher and more rounded above than in *claviger* ♀.	6. Petiole considerably thicker, higher and more rounded above.
7. Mandibles similar to those of *claviger* ♀.	7. Mandibles with fewer teeth than in *claviger* ♀ (Fig. 3 *C*).

8. Antennal scape and funiculus shorter and broader. (Fig. 2, *B*.)

8. Antennal scape and funiculus still shorter and broader. (Fig. 2, *C*).

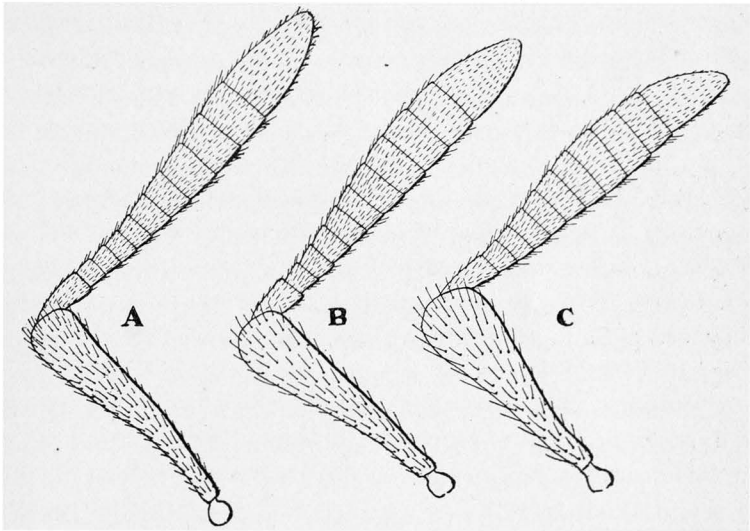


FIG. 2. *A*, Antenna of *Lasius claviger* ♀ ; *B*, of *L. latipes a*-♀ ; *C*, of *β*-♀.

9. Trochanters, femora and tibiæ broader and more flattened.

9. These joints extraordinarily flattened and dilated.

10. Strigil a little smaller.

10. Strigil much smaller.

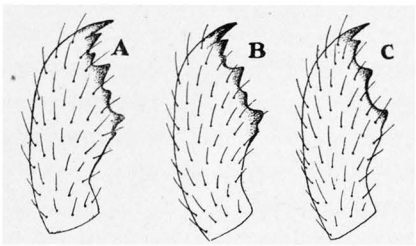


FIG. 3. *A*, Mandible of *Lasius claviger* ♀ ; *B*, of *L. latipes a*-♀ ; *C*, of *β*-♀.

11. All the tarsi a little more tapering.

11. Tarsi rapidly tapering.

12. Middle and hind tarsi nearly as long as the tibiæ.

12. Middle and hind tarsi much shorter than the tibiæ.

Turning now to a comparison of the two species, *latipes* and *claviger*, as exhibited by the workers and males, we find but few

points of difference, so that we are compelled to regard the two species as very closely related to each other. The worker *latipes* has a thicker petiole, which is distinctly blunt and rounded above, and the hairs are somewhat more abundant and evenly distributed on the dorsal surface of the gaster. In the worker *claviger*, on the other hand, the petiole is thinner anteroposteriorly and sharply cuneate above when seen in profile, and the gaster is less uniformly hairy and somewhat more shining. The males of the two species differ much as do the workers in the shape of the petiole. Moreover the male *claviger* is decidedly larger, more robust and blacker than the male of *latipes*. These differences, especially in the males, are easily appreciated in the living specimens when they are seen in numbers, but are necessarily more obscure in dried cabinet specimens.

From these comparatively slight differences between the males and workers of the two species we should naturally expect to find a corresponding similarity in the females. It is quite obvious that the α-female is the very form which satisfies this requirement, whereas the β-female presents extreme characters which make it appear like a decided sport or aberration from the normal type of *Lasius* female. It would seem, therefore, that the β-female is the one for which we are most in need of an explanation, although it is connected with the females of normal form by a rather complete series of gradations, *i. e.*, through the females of the following species, beginning with the most extreme form: *L. Murphyi*, α-female of *latipes*, *claviger*, *interjectus*. The remarkable configuration of the legs and antennæ, the color and pilosity of the β-female all suggest some peculiarity of habit or habitat the nature of which remains to be determined by further observation and experiment.

We come now to the important question: What is the meaning of this dimorphism in the females of *L. latipes?* From the fragmentary data at our command it would seem that four different hypotheses might be advanced to explain this peculiar phenomenon:

1. It may be suggested that the α- and β-females really belong to two distinct species. According to this view the α-female might be regarded as the true queen of *latipes*, whereas the

β-form would represent the queen of some inquiline or symbiotic species. Although this explanation is readily suggested by the well-known cases of dulosis and xenobiosis in ants, we are, nevertheless, bound to reject it for the following reasons: Though the β-females were taken in several nests and, in one case, were seen to celebrate their nuptial flight at the very same time as the α-females, no males or workers which could represent any species except *latipes* were to be found in the nests. The same argument would hold *mutatis mutandis*, were we to consider the β-form as the only true female of *latipes*. The workers and males of all the known North American Lasii have been accounted for, and there is still a female form left over, so that there is no species known that could be enslaved by, or live as an inquiline with, *L. latipes*. We should have to suppose that the inquiline species was represented by females only, and this is most improbable. Finally, the deep coloration above noted as occurring in the β-females of nest No. 5 would indicate that both the α- and β-females belong to the same species. We believe, therefore, that this hypothesis may be safely rejected.

2. It may be suggested that the α-female is the normal female of *latipes*, whereas the β-females are diseased forms — individuals afflicted with some strange emmet elephantiasis or acromegaly! But even apart from the very frequent occurrence and uniform development of the β-females, dissection shows that such a view cannot be seriously entertained. Their internal structure is in no respect abnormal. The fat body is well developed and the ovaries are in the same stage and have the same normal structure as the ovaries of the α-females. If anything, the β-females are more vigorous, somewhat larger and supplied with more fatty tissue (even in the distal lobes of the large fore femora!) than the α-females. In a word, the β-females are somewhat above normal, while the α-females, so far as we are able to judge, are quite normal. Hence this hypothesis, also, may be safely rejected.

3. The dimorphism may be regarded as the result of hybridism between *L. claviger* and *L. latipes*. This view is supported by the following considerations:

(*a*) Both species occur in the very same localities, and *latipes* is much rarer than *claviger*. Hence the queens of the latter may

find cross-fertilization by males of their own species from other nests very difficult and fertilization by males of *claviger* a relatively easy matter.

(*b*) The nuptial flights of the two species may occur simultaneously. In fact, the senior author witnessed a flight of *claviger* from a nest not twenty feet away from the *latipes* nest and at the very same time (3.30 P. M.) as the above-described flight of the latter species. And it may also be stated that both these nests were large and must therefore have existed side by side for some years. We could suppose that a β-female of *latipes* in some previous year had been fertilized during her nuptial flight by a male *claviger* and had returned into the parental nest to give birth to the α-females which celebrated their nuptial flight on the 17th of September, 1902.

(*c*) This view is also supported by the fact that the α-female is so clearly intermediate in nearly all its characters between the female *claviger* and the β-female, as has been shown in the above tables.

The arguments that can be brought to bear against the hypothesis are the following:

(*a*) We have failed to find any hybrid workers in the nests containing the α- and β-females. This should be the case unless we suppose that all the hybridized β-females produced only queens.[1] But it must be borne in mind that the hybrid between the worker *claviger* and worker *latipes* would differ presumably from the parent species only in intermediate pilosity and in having a petiole intermediate in shape. Such differences would not be easily detected, as anybody will confess who has examined a large series of workers of the two species. The workers are of small size and the petiole is sometimes decidedly variable even within the limits of the same species of *Lasius*.

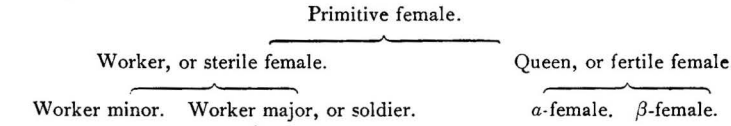
(*b*) It is improbable that hybridization could occur so frequently in a state of nature as appears to be indicated by the high percentage of nests containing α-females, and their occurrence in such widely separated localities. If we are really confronted by a case of hybridism we are almost compelled to believe

[1] Obviously the male offspring of the hybridized queen would not be affected, since they arise from unfertilized eggs.

that the α-female must be sterile, notwithstanding her well-developed ovaries, or the two species would long since have merged into one.[1]

(*c*) It seems improbable that such an aberrant creature as the β-female would mate with the male of another species, but this argument loses much of its force when we stop to reflect that the *claviger* male is very similar to the *latipes* male even in the structure of its genitalia.[2]

4. We may suppose that we are dealing with a true case of dimorphism in the female sex. On first thought this seems improbable because dimorphic queens, in the strict sense of the term, are unknown among ants. But when we stop to consider that the social bees and wasps exhibit an essentially similar dimorphism, except that one of the two winged forms, the worker, is sterile (and this may also be the case with the α-female of *L. latipes!*) there is nothing preposterous in this view. Moreover, in ants the wingless workers have themselves in many species become dimorphic, developing soldier and typical worker forms, either perfectly distinct from each other or connected by a series of intermediates. Why, then, may we not expect the winged queens in some cases to exhibit dimorphism among themselves, especially when dimorphism "runs in the blood," so to speak, of all the social Hymenoptera? And why may not *L. latipes* be such a species in which the old and deeply-rooted tendency is breaking out in a novel form? This would at least complete the theoretical possibilities in female ants as represented in the folfowing diagram:



It thus appears that of the four hypotheses, two may be rejected as too improbable to be entertained, and that the true meaning of

[1] Unless, indeed, the Mendelian law be supposed to operate with unprecedented clearness in this particular case.

[2] In this connection, however, it is interesting to note that Marchal ('96, p. 45) failed to induce mating between two very closely allied species of wasp (*Vespa germanica* and *V. vulgaris*).

the dimorphism of the females of *L. latipes* is to be sought in the direction of hybridism or of dimorphism *sensu stricto*. Only further observation and especially experiment can enable us to decide which of these interesting alternatives confronts us.[1]

For the present we incline to the belief that the α- and β-females of *latipes* represent true dimorphic forms, and see in this condition an interesting repetition of what may have led to the differentiation of the primitive winged female ant into workers and queens. It is granted on all sides that insects like the ants, social wasps and bees, which present three sexual phases, viz., males, queens and workers, are to be derived from forms with only a single female form. In the bees and wasps there can be no question that this original female form was winged like the male, and we should expect this to be the case also with the ants, but so eminent a myrmecologist as Professor Emery takes quite a different view of the matter ('95*b*, p. 775). He says: "If the above considered derivation of ants from Mutillid-like Hymenoptera be granted, we must suppose, furthermore, that in primitive ants, as in the Mutillids, the males were winged, but the females wingless, and that the latter subsequently reacquired wings. This supposition is upheld by the fact that wingless females are most commonly met with among the Dorylinæ and Ponerinæ, *i. e.*, in those very groups of ants which are the most primitive, more rarely among the Myrmicinæ, and most rarely, and, so far as I am aware, only as individual anomalies, in the Dolichoderinæ and Camponotinæ. The frequency of occurrence of wingless females is, therefore, inversely as the phyletic stage of development of the different groups of ants.

[1] In the Lepidoptera and Hymenoptera, if we except a few cases like the Torymid Chalcididæ, the female sex seems to be more prone to dimorphism than the male. In Diptera the few recorded cases of dimorphism occur in males; *e. g.*, in the Brazilian *Curupira torrentium* (Fritz Mueller, '81; Osten Sacken, '95) and the North American Syrphid *Mallota cimbiciformis* (Williston, '86). Among the Coleoptera *Dytiscus* presents dimorphism in the females, while some of the Anthribidæ are said to show it in the males. The dimorphism seen in the "high" and "low" males of the Scarabæidæ among the Coleoptera and the "high" and "low" male Dermaptera (*Forficula auricularia*) observed by Bateson ('94, pp. 40-42), resembles that of the female *Lasius latipes* in being a normal and excess development of the individuals of the same sex. In the latter case, however, the two forms are not connected by intermediate variations.

"Not only is the normal occurrence of wingless females among existing species evidence of a similar condition among the primitive ants, but it also furnishes the most natural explanation of the origin of the wingless workers. I surmise that *the ancestral ants constituted small societies of wingless females, among which sterile individuals were subsequently differentiated as workers.* The wings, so readily deciduous in the queens of existing ants, were newly acquired from rudiments still persisting in the ontogeny, by a process of reversion to the winged ancestors."

We are unable to assent to this view, for the following reasons:

1. While there is no end of evidence to show that the most diverse insects have lost their wings during phylogeny, there is not, to our knowledge, a single insect which can be satisfactorily shown to have reacquired these organs. At any rate the losing of wings is a much easier process than their acquisition.[1]

Emery's hypothesis postulates a winged condition in both sexes of the ancestors of Mutillidæ, a loss of the wings in the females of the Multillid-like ancestors of ants, a persistence of this primitive condition by inheritance in the ancestral Formicidæ and a comparatively recent reacquisition of wings in the females of all except the Dorylinæ and the few Ponerine genera which have wingless females (*Leptogenys*, *Acanthostichus*). This would seem to be a needless complication of matters, apart from the fact that it is venturesome to invoke the obscure principle of reversion to account for the reacquisition of organs.

2. Existing wasps and bees certainly show the possibility of differentition into workers and queens prior to the loss of wings.

[1] This is an interesting case of a principle to which Headley ('01, pp. 100, 101) has recently called attention: "The sudden loss of horns brings out a point to which, I think, attention has never been directed in discussions on pammixis. The evolution of new characters is a gradual process requiring ages of time. Geology shows that the stag's antlers have grown step by step from small beginnings. But they might be completely lost in a single generation. The horns of cattle, though less magnificent, are none the less the slow product of ages of unintermitted selection. But by a sudden freak they disappear utterly in an individual here and there, or leave only a dangling vestige attached to the skin.

"Those evolutionists who love symmetrical theories, mapped out regardless of observed facts, imagine a process of retrogression by which all the stages are retraced in ordered succession. What actually happens is usually very different. An elaborate organ is suddenly much reduced and mutilated or suddenly disappears altogether."

And there is no strong evidence to show that this condition did not exist in the ancestral ants, for the Dorylinæ are hardly in the direct line of Formicid descent, and the Ponerinæ, though very primitive, still show the differentiation into winged queens and wingless workers in some of their most generalized genera (*Cerapachys*, *Sysphincta*, *Proceratium*, etc.).

3. That the most natural way of accounting for the wingless workers is through loss of the organs of flight in one of the two winged female forms, is also indicated by the phenomena of ergatomorphism among male ants. It is known that in a few sporadic species belonging to several genera the males are wingless and have assumed a worker-like form, especially in the development of the thorax. These species are, *Anergates atratulus* (Schenck '52), *Formicoxenus nitidulus* (Adlerz '84), *Cardiocondyla Stambuloffii* (Forel '92), *Ponera punctatissima* (Emery '95*a*) and *P. ergatandria* (Forel '93). This same reduction of the wings is shown in a more or less advanced condition in some male Mutillidae: All these cases are most naturally explained by loss of the organs of flight, and we are justified in adopting the same explanation to account for the wingless condition of the workers. Our view of the matter, therefore, would differ from Emery's in assuming that in the ancestors of the ants all three forms, workers, queens and males, were alike winged, and that the workers lost their wings either suddenly in accordance with Headley's principle, or concomitantly with the atrophy of the ovaries and the assumption of the other worker characters. Thus it would be the workers that have lost their wings and the queens have not reacquired, but retained these organs which came to them as the common heritage of all the Pterygote insects.

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AUSTIN, TEXAS,
December 5, 1902.

A NEW KOENENIA FROM TEXAS.

By AUGUSTA RUCKER.

Reprinted from 'The Quarterly Journal of Microscopical Science.'

A New Koenenia from Texas.

By

Augusta Rucker,

Of the University of Texas, U.S.A.

With Plate 18.

During the later part of July I received from Bonham, Texas, a small package of soil containing Koenenia, which was sent by Miss Florence Rhine. The distance from Bonham, which is in the northern part of the State, near Red River, to Austin was so great, and the heat at that time was so intense, that the soil, which was in a paper box, became perfectly dry before it reached me. However, on placing the dry earth in a large dish of water, several specimens of Koenenia, in a wrinkled and distorted condition, were floated out and taken up with a brush. The wrinkles were smoothed out, by the use of KOH, to an extent that allowed of a partially satisfactory examination of the exoskeleton. The first glance at the ventral surface of an adult female revealed the fact that an entirely new species of Koenenia had been taken.

A hasty review of the eleven specimens obtained from the dry soil showed eight to be adult females and three immature forms. Hoping to obtain perfect specimens, I immediately wrote Miss Rhine for more material, asking that it be sent in 70 per cent. alcohol. At the same time I wrote for informa-

tion on the conditions under which the little Arachnids were found, for I thought I knew the soil of Bonham to be made up of a black-waxy alluvial, entirely free from stones. This condition would necessitate their living entirely in the soil, independent of stones—a condition which I suspected to obtain in the case of K. wheeleri, though the prevalence of several stones in the soil where the latter were found made it more doubtful.

In immediate reply to both of my requests, on August 3rd I received fifty-five specimens of the new Koenenia, and the following information in regard to their environment:—"I was looking under a cedar hedge for a suitable soil for ferns, shortly after a rain, when I discovered the Koenenia which I sent you. In that place the soil was moist to the depth of several inches, and there the animals were found in greater numbers than I had ever seen them in Austin. I could hardly dig up a spoonful of the soil that did not contain as many as four specimens. The top of the earth was of a dark reddish-brown colour, due to the deposits for years of decayed cedar branches; below this the soil was very dark, and here the Koenenia were readily observed moving about incessantly. There were no stones anywhere in the neighbourhood, the conditions being unlike those found in Austin. . . . . On receiving your letter asking for more material, I was sorry to find the earth quite dry, and no Koenenia in sight. In the evening, however, I watered the hedge thoroughly, and early the next morning I procured as many as I supposed you would want."

On examining the fifty-five specimens sent, I found that they consisted principally of adult females, though a few represented two developmental stages. Hoping to get individuals of both sexes, I again begged for more material, and on August 29th received fifty-six specimens, while in September sixty more were added, making in all one hundred and eighty-two specimens which I had received. Careful examination of all these revealed the same condition that was found in the case of the European K. mirabilis, of which

not a single male had been taken up to the present time. This seemed all the more remarkable, since in the other Texan species (K. wheeleri) the males at times predominate.

Koenenia florenciæ, n. sp.

In size K. florenciæ measures from 2 to 2·3 mm. In its proportions it is not unlike K. wheeleri.

Cephalothorax.—The labrum presents a laterally compressed condition, and viewed from the ventral or dorsal surface, appears to terminate in a peak. Five pairs of labral hairs are present. These hairs are as prominent as the corresponding ones in K. mirabilis, and twice as prominent as those of K. wheeleri, where they might be easily overlooked. The hypostome presents the usual cross-furrowed appearance, resulting from the arrangement of the delicate hairs of that region. The frontal sense-organ is of normal appearance, projecting forward from under the blunt-pointed carapace. The lateral sense-organs consist of three pairs of spindle-shaped hairs with the proximal ends blunted at their point of attachment. These sensory setæ are six times as long as they are broad at their broadest axis, and are dotted over with delicate hairs. They lie close to the head, and point forward and inward, arising in such a manner that when seen from above they can hardly be counted, so nearly do they lie in the same dorso-ventral plane. When seen from the side they stand out with great distinctness. The number and arrangement of the dorsal hairs of the cephalothorax are not characteristic of the species, inasmuch as the same arrangement is met with in K. wheeleri. There are five cross-rows of hairs; the first consisting of one pair, the second, third, and fifth, each of two pairs, and the fourth of three pairs of setæ. The number and arrangement of cephalothoracic sternal hairs are characteristic of the species. In every specimen examined for this purpose except one, which had six, five prominent setæ are present. These arise in a slightly curved line, which extends over about a third of the

breadth of the animal across the mid-ventral line. Another characteristic of K. florenciæ, which appears even in the delicate exoskeleton of the youngest stage, is a tongue-shaped thickening of the sternum between the fifth pair of appendages.

Cheliceræ.—On the ventral surface of the proximal joint of the cheliceræ three setæ arise in a line parallel to the sides of the labrum. These setæ present distinguishing features characteristic of the species. In K. florenciæ the first one of these hairs is very large,—in fact, it is the largest hair to be found on the entire body of the animal; while the other two setæ are very small in proportion. The corresponding setæ in K. wheeleri which are similarly arranged are all of the same size, blunt, and delicately plumulose near the ends. In the case of K. mirabilis the first of these hairs is large, but not nearly so large as the corresponding ones in K. florenciæ. The size and relative proportions of these setæ can best be ascertained from an examination of figs. 9, 10, and 11 of the plate. The two distal joints have each eight teeth with their denticles. The teeth, in recently killed specimens, show a delicately plumulose structure, a condition which was also found in K. wheeleri. On the fixed blade the row of teeth ends with a sharp angle, while the moveable blade, which ended with a number of serrations in K. wheeleri, terminates with the last tooth. A peculiar arrangement in the fixed blade of K. florenciæ, which is so prominent as to make it worth mentioning, can best be made out from fig. 12 of the plate. This condition, though not so prominent, is also observed in the movable joint. It is a bulb-like attachment appearing in the cavity of the blade, on a line with the penultimate tooth. Extending from that side of the bulb nearest the teeth is a chitinous rod which becomes fused with the wall of the blade after extending down the cavity for its whole length.

Other Appendages.—The pedipalps conform throughout to the corresponding appendages in the other known species. The last leg, like that appendage in K. wheeleri, has, on the

upper surface of the metatarsus, a large, hollow, sensory seta, which arises at about the middle of the joint. As would be expected from our knowledge of the other members of this group, K. florenciæ has the usual number of seven delicate sensory setæ. The first one arises from the outer surface of the patella, one third of the distance from its distal end. The next two arise from the upper and distal limit of the first metatarsus, while the second metatarsal joint bears one on the proximal limit of its upper surface, and one near the middle on the outer surface. The fourth metatarsus and second tarsus each gives off one of these hairs from its upper surface. So far as I am aware no statement has been made in regard to the proportionate length of these delicate organs. In K. florenciæ the uppermost hair of the first metatarsus and the one arising from the second tarsus are only of about half the length of the other metatarsal hairs, while the corresponding hair of the patella is lacking somewhat in length. Bifurcating hairs are present on the first and second metatarsus, and second and third tarsus. Characteristic of the species is the size and the situation of the large, hollow, flat seta of the third metatarsal joint. This seta is situated at about one half of the distance from the proximal end of the joint. It is shorter and narrower than the corresponding organ in K. wheeleri, which arises from the distal end of the joint. In K. florenciæ, on the opposite side of the joint from where the seta arises, is another hollow though round and pointed seta, which is much longer and almost as broad.

The Abdomen.—In K. florenciæ is found the usual belt of setæ on all eleven of the segments except the first. It is in the arrangement of these setæ that K. florenciæ differs from all of the other described species. Along the dorsal and lateral surfaces of the abdomen, a strip, made conspicuous by the absence of setæ, extends to the seventh segment. The remaining are regularly adorned with setæ at approximately equal distances apart. The most striking differences between the two Texan Koenenia are to be found on the ventral surface of the abdomen. No lung-sacs are present in K.

florenciæ. In sections, however, the region corresponding to the lung-sac areas reacts to stains in exactly the same way as do the cells around the inverted lung-sacs of K. wheeleri. Specimens stained in borax carmine show three pairs of deeply stained patches on the ventral surfaces of segments 4, 5, and 6. The arrangement of the setæ on the ventral surface is entirely different from any other described species. On segments 4, 5, and 6, just over the peculiarly stained areas above mentioned, there is a crowding of the setæ of the belts, so that two groups of four setæ each are observed on each side of the mid-ventral line. From their situation these setæ correspond to the four pairs of protective setæ of the lung-sacs of K. wheeleri. Like K. siamensis, K. florenciæ presents an identical appearance of the ventral surface of segments 4, 5, and 6. Segment 7 is likewise lacking in a seta on its mid-ventral surface, while all the remaining segments are regularly supplied with setæ, which occur much oftener than in the other segments.

Reproductive Appendages.—Only the female appendages can be described, since males were lacking among all the specimens taken. Why such a condition exists in all the other species except K. wheeleri is a matter yet to be accounted for. While the males are lacking, the females must suffice to give specific character. In describing the appendages of the female almost the same description will hold good for K. florenciæ as was given for K. wheeleri. The anterior unpaired appendage of the second segment appears more pointed when viewed from below; while, when seen in profile, the sides of the appendage project backward and upward, forming a very deep trough with very thin sides. So thin are the lateral extensions of this appendage that they are easily overlooked in specimens thoroughly cleaned in KOH. The setæ of this appendage consist of ten pairs. The first row at the base, made up of three pairs, curve slightly downward. The second row of two pairs is situated further down on the appendage, and curves slightly in the opposite direction. The remaining hairs are arranged

in a somewhat irregular row on and near the edge of the appendage. The paired triangular appendages of the third segment, as usual, have three pairs of setæ—two long ones, arising on the posterior surface or from underneath, when viewed from the ventral surface, and a small one situated on the side of each appendage. The blades of these appendages are more pointed than the corresponding ones in K. wheeleri. Shining through the unpaired portion, and opening between the bases of the two paired ones of the reproductive appendages, is seen the large seminal vesicle, which is nearly oval in outline. This vesicle in K. wheeleri was flask-shaped, with the neck of the flask projecting downward. Figs. 6 and 7 of the plate show the true condition of these appendages better than any amount of description.

Flagellum.—When the material reached me through the mail the flagellum had been broken off in every case except one. This was an adult female, which had only twelve joints in the flagellum. However, I found floating around in the alcohol in which the specimens were sent, one flagellum of fifteen joints (counting the first small joint, which is never detached with the flagellum, but always remains with the body), another of fourteen joints, and another of twelve joints. In all these cases none of the proximal joints had been broken off except the small joint of which I have made mention. In these four flagella the second, third, fourth, sixth, eighth, and tenth joints had two whorls of setæ; a plumulose whorl of long setæ running around the middle of the joint, and a smooth terminal set which fitted closely over the subsequent joint. Always following the joint bearing the double whorl of setæ which precede the segment-bearing whorl of hairs are the very short, thick-walled sub-joints which may be looked upon as the anterior portion of the large joints, to which they are immovably attached. The terminal joint in two cases had two whorls of plumulose setæ; in the other two flagella it bore only one whorl. In every instance, except in the number of joints, the flagellum carries out all the observations made on the corresponding appendage in K. wheeleri.

Immature Stages.—These would be hardly worth mentioning, so fragmentary is the information obtained from two periods in the life-history, were it not that these two stages may give characters which phylogenetically are of the utmost importance. As is always expected in considering the young of any Arachnid, the hairs are few in number when compared with the adult, so these points can be passed over lightly except where hairs appear as specific characters of K. florenciæ. Of special importance, however, is the development of the reproductive appendages of the second and third abdominal segments. We saw that these appendages of K. wheeleri, in passing through their developmental stages, not only gave an inkling of the condition to be found in the male appendage of the adult, but also of the relative position of the species within the order. In K. florenciæ the older known stage presents characters in the reproductive appendage which become entirely lost in the adult female, but which resemble, in their possession of papillæ, the male appendages in K. wheeleri. The appendage of this stage in K. florenciæ, with greater elaboration brought about in its further development, probably becomes the male appendage of the adult; further collection, however, at different times of the year is needed to prove the truth of this conclusion.

Youngest known Stage.—The labrum presents the peaked condition found in the adult. One lateral sense-organ is present on each side. The number and arrangement of setæ on the carapace agree with the adult condition. Only one cephalothoracic sternal hair is present; this is situated on the mid-ventral line. No sensory hairs appear on the first metatarsus. The flat, hollow, and slightly curved seta situated on the outer side of the third metatarsus, one third of the distance from the proximal end, is present as in the adult. The characteristic setæ of the proximal joint of the cheliceræ occur as in the adult. The arrangement of setæ on the ventral surface of the abdomen is very regular. Beginning with the second segment and ending with the seventh segment

there are two longitudinal rows of hairs on either side of the mid-ventral line. In segment 3 these hairs are placed farther apart and farther from the mid-ventral line, thus making the longitudinal lines slightly curved. The seventh and eighth segments have one seta on each side of the mid-ventral line, while segments 9, 10, and 11 have one on each side and one on the mid-ventral line.

Second and Last known Stage.—The labrum is compressed laterally, and has four pairs of hairs. Usually two lateral sense-organs are present on a side, though in one case only one was observed on a side. There are three cephalothoracic hairs. The appendages have all the characteristics present in the adult. On the ventral surface of the abdomen the fourth, fifth, and sixth segments have each a group of three hairs, to the right and left respectively of the mid-ventral line, while the seventh segment has only one on a side; the eighth and eleventh segments have each three setæ, one on, and one on each side of the mid-ventral line; while the ninth and tenth segments have each four setæ arranged at equal distances apart across the ventral surfaces. It is the peculiar condition of segments 2 and 3 that makes this stage of the utmost importance. These segments are prolonged into appendages that give promise of becoming male appendages, inasmuch as they possess papillæ, a condition which has been found only in the male. The second segment is prolonged posteriorly and ventrally into a trowel-shaped appendage, slightly notched at the edge, giving it a paired appearance. There projects from its edge on either side of the mid-ventral line a papilla tipped with a plumulose spine. This appendage has four pairs of setæ, two pairs forming a downward curving row, while the two remaining pairs form an irregular row near the edge. The third segment gives rise to the usual pair of projections, which are supplied on the outer side with a small seta. Figs. 13 and 14 of the plate represent camera drawings of the front and side view of these simple appendages.

The Endosternite.—Characteristic of the Arachnida is

this endoskeleton, which lies in the cephalothoracic region between the nerve chain below and the stomach above. This organ, which is easily overlooked in K. wheeleri, has not been described for that species, but it has already been observed in K. mirabilis and represented in section by Mr. Börner. In K. florenciæ the endosternite comes out perfectly into view while a specimen is being treated with KOH. In K. wheeleri this is not the case, and unless one is on the sharp look-out it entirely escapes the notice, so readily does it dissolve away on the use of KOH, along with the surrounding muscle and nervous tissue. In K. florenciæ the endosternite is a **V**-shaped continuous plate, slightly swollen at the sides in the region between the fifth appendages. Posterior to these swellings, and more medianly situated, are two large triangular perforations, which may be said to divide the plate into two regions, an anterior **U**-shaped portion and a posterior **V**-shaped portion, which contains the above-mentioned perforations. Near the anterior limits of the arms of the **U** are two pairs of small oval apertures, while in the outermost edge of the base of the **U** are three oval apertures on either side. The attachment of the muscles of the endosternite I did not attempt to make out. Fig. 15 of the plate will make much clearer than descriptions can the structure of the endosternite.

Systematic.—Following the discoveries made by Dr. Silvestri of two species of Koenenia in South America, and by Dr. Mortensen on the island of Koh Chang, in the Bay of Siam, of two other species, comes the new North American and North Texan Koenenia, which makes it seem all the more probable that the hitherto rare order is well represented over the globe. That one of the South American species—K. chilensis, Hansen—possesses lung-sacs, while the other—K. grassi, Silvestri—does not, and that the same condition occurs in the case of the two North American species—K. wheeleri possessing lung-sacs, while K. florenciæ does not,—is a point of great interest which invites further

consideration. From an analytical standpoint, the presence of these lung-sacs in some species only, seems sufficient ground for a definite and well-marked division of the genus Koenenia into two sub-genera. Mr. Börner[1] was the first to make the suggestion, basing the distinction on the condition of the reproductive appendages. Unfortunately he was misled, by Dr. Wheeler's mistaken description of the male for the female, into believing that the appendage of the second abdominal segment in K. wheeleri was paired, and represented a more primitive condition; hence he placed K. wheeleri under the sub-genus Prokoenenia, while the then only other known species, K. mirabilis, he placed under the sub-genus Eukoenenia. However, inasmuch as K. mirabilis presents a slightly paired or notched condition of the reproductive appendage, and inasmuch as K. wheeleri passes through a stage in its development[2] which is more nearly comparable to K. mirabilis, their position in the sub-genera would have to be reversed if we attempt to carry out Mr. Börner's suggestion. With his permission, then, I adopt his sub-genera Prokoenenia to include all species possessing lung-sacs, and Eukoenenia to include those species not possessing lung-sacs.

In regard to exact characters indicative of the species, further observations will have to be made before anything like a definite and concise analytical table can be arranged. Of the three species which I have been able to examine and compare—K. wheeleri, K. mirabilis, and K. florenciæ —the relative size of the three more distal setæ of the proximal joint of the chelicerae was a prominent and characteristic feature of the species. In descriptions[3] of the other four species no stress is laid on the distinction; and the setæ are figured in only one of the species, K. angusta. For the

[1] "Zur äuf seren Morphologie von Koenenia mirabilis, Grassi," aus dem 'Zoologischen Anzeiger,' Bd. xxiv, No. 652, p. 551.

[2] 'Zoologische Jahrbücher,' 1903.

[3] "On Six Species of Koenenia, with Remarks on the Order Palpigradi," H. J. Hansen, 'Entomologisk Tidskrift,' 1901.

three species which I examined, the ventral view showing the relative size of these setæ, the arrangement of the hairs of the fourth, fifth, and sixth segments of the abdomen, and the number and arrangement of the cephalothoracic sternal hairs, give an immediate clue to the species. In arranging any analytical table these specific points should come first in consideration. The females, which probably differ from the males only in their reproductive appendages, must be used entirely in furnishing the description for the species.

A. Lung-sacs present on the ventral side of the fourth, fifth, and sixth segments of the abdomen.

Prokoenenia.

1. Between the lung-sacs on segments 4 and 5 are three pairs of long backward turning hairs. These hairs are absent on segment 6. A group of four shorter hairs is present for protection over the aperture on each lung-sac. Usually fifteen cephalothoracic sternal hairs are present, eight of which are arranged in a transverse row, and seven form a V anterior to this row. The three setæ of the proximal joint of the cheliceræ of equal size. Labrum rounded anteriorly, and possessing along its lip six pairs of delicate hairs. A group of four lateral sense-organs present on a side. The stiff, hollow seta is situated on the distal limit of the third metatarsus of the first leg.

Koenenia (Prokoenenia) wheeleri. Rucker.

2. No long hairs are present between the lung-sacs. Ventral surfaces of the fourth, fifth, and sixth segments are alike. A group of three hairs is present over the orifice of each lung-sac. Eight cephalothoracic sternal hairs are present, arranged at the corners of two concentric rectangles. Two lateral sense-organs are present on a side. The flat, hollow seta is situated at the middle of the third metatarsus of the first leg.

Koenenia (Prokoenenia) chilensis. Hansen.

B. Lung-sacs absent from the ventral surface of the fourth, fifth, and sixth segments of the abdomen.

Eukoenenia.

3. "On the ventral surface, a group of five or six spine-like setæ on the fourth segment, and a protruding wart with six procurved setæ on the sixth segment." Two slightly curved, transverse rows of five and six setæ respectively are present on the sternum of the cephalothorax. The three setæ of the proximal joint of the cheliceræ are all of different lengths, the most distal one being decidedly the longest. Labrum more rounded, with five pairs of lip hairs. One lateral sense-organ present on a side. The hollow seta of the third metatarsus of the last leg is inserted at the middle of the joint.

Koenenia (Eukoenenia) mirabilis. Grassi.

4. Fourth segment of the abdomen has on its ventral side one seta on each side of the mid-ventral line, while the fifth and sixth segments have two setæ on a side. Three cephalothoracic sternal hairs are present arranged in a transverse row. A group of three lateral sense-organs are present on a side. The stiff hollow seta is inserted near the base of the third metatarsus of the first leg.

Koenenia (Eukoenenia) angusta. Hansen.

5. Ventral surfaces of the fourth, fifth, and sixth segments of the abdomen have, on each side of the mid-ventral line, two setæ. Seven cephalothoracic sternal hairs are present, arranged in two intersecting diagonal rows. A group of three lateral sense-organs is present on a side. The stiff, hollow seta is inserted at the middle on the third metatarsus of the first leg.

Koenenia (Eukoenenia) siamensis. Hansen.

6. Ventral surfaces of the fourth, fifth, and sixth segments have on each side of the mid-ventral line a group of four hairs. The cephalothoracic sternal hairs consist of five,

arranged in a transverse row. The anterior seta of the proximal joint of the chelicerae four times longer than either of the other two. Labrum compressed laterally to a point, and possessing on its lip five pairs of hairs. A group of three lateral sense-organs is present on a side. The flat, hollow seta situated one third of the distance from the proximal limit of the third metatarsus of the first leg.

Koenenia (Eukoenenia) florenciæ.

7. Ventral surfaces of the fourth and fifth segments of the abdomen with a group of four hairs on each side of the mid-ventral line, while only three pairs of hairs are present on the sixth segment. Eight cephalothoracic hairs are present, irregularly arranged. A group of three lateral sense-organs is present on a side. The stiff, hollow seta is inserted near the base of the third metatarsus of the first leg.

Koenenia (Eukoenenia) grassii. Silvestri.

In conclusion I have arranged in a convenient form the table given below, which records the places from which the species were taken, together with the more prominent characters of each species.

	K. mirabilis.	K. wheeleri.	K. chilensis.	K. angusta.	K. siamensis.	K. grassi.	K. florenciæ.
Lung-sacs	0	3 pairs	3 pairs	0	0	0	0
Hairs of cheliceræ	1 large, 1 medium, 1 small	3 of equal size.	Undetermined	1 large, 2 small	Undetermined	Undetermined	1 very large, 2 small
Number of cephalothoracic sternal hairs	10 to 11	15	6	3	7	8	5
Hairs between lung-sac area	Segment 4, 5 or 6; segment 6, 6	Segment 4, 3 pairs; segment 5, 3 pairs; segment 6, none	0	0	0	0	0
Number of hairs in group over lung-sac area of fourth segment	—	4 pairs	3	1	2	4	4
Number of hairs in group over lung-sac area of fifth segment	—	4	3	2	2	4	4
Number of hairs in group over lung-sac area of sixth segment	—	4	3	2	2	3	4
Number of lateral sense-organs in a group	1	4	2	3	3	3	3
Type locality	Italy and Sicily	Austin, Texas	Chile	Koh Chang, Bay of Siam	Koh Chang, Bay of Siam	Paraguay	Bonham, Texas.

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EXPLANATION OF PLATE 18.

Fig. 1.—Dorsal view of K. florenciæ (8 oc. × 3 obj.). The setæ of head, thorax, and abdomen are shown in their natural position. The abdomen is slightly rolled to the left, so that the broad strip along the mid-dorsal line which is devoid of setæ is not so striking.

Fig. 2.—Ventral view of the head and thorax of K. florenciæ (1 oc. × 7 obj.). The arrangement and position of setæ of the proximal joint of the cheliceræ are shown. The distal joints of the cheliceræ which often obscure the setæ are not drawn. The characteristic peaked condition of the labrum with its curved row of five pairs of hairs is shown. The five cephalothoracic sternal hairs are shown in their natural position. The peculiar thimble-shaped thickening of the sternum between the fifth pair of appendages appears in all the stages as is figured here in the adult.

FIG. 3.—*a*. Lateral sense-organs in natural position when viewed from above. *b*. The same seen from the side and slightly displaced through pressure (8 oc. × 7 obj.).

FIG. 4.—Frontal sense-organ (8 oc. × 7 obj.).

FIG. 5.—The first leg of the left side beginning with the patella. The relative lengths of the sensory hairs are correctly drawn (1 oc. × 7 obj.).

FIG. 6.—Female reproductive appendages (1 oc. × 7 obj.).

FIG. 7.—Ventral surface of abdomen of adult female showing position of setæ (8 oc. × 3 obj.).

FIG. 8.—*a*. Large seta from proximal joint of chelicera of K. florenciæ. *b*. The corresponding seta of K. wheeleri (8 oc. × 7 obj.).

FIG. 9.—Chelicera of K. florenciæ when seen from the under side (1 oc. × 7 obj.).

FIG. 10.—Chelicera of K. mirabilis when viewed from the inner side (1 oc. × 7 obj.).

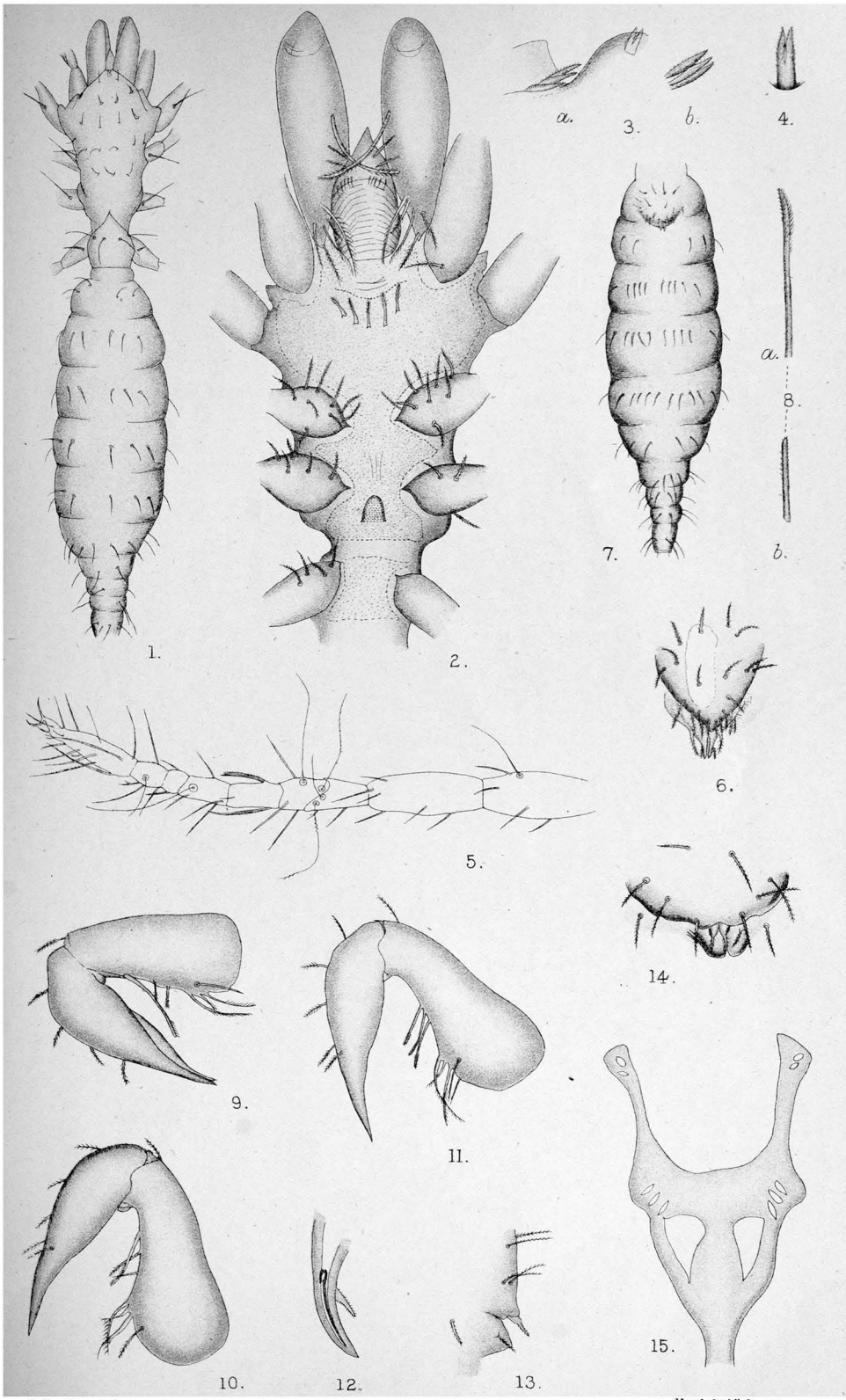
FIG. 11.—Chelicera of K. wheeleri. Same view and same magnification.

FIG. 12.—Tip of fixed joint of chelicera of K. florenciæ showing the peculiar chitinous arrangement in its cavity (8 oc. × 7 obj.).

FIG. 13.—Side view of the reproductive appendages in the oldest ontogenetic stage found (8 oc. × 7 obj.).

FIG. 14.—Front view of the same region which has been flattened out through pressure.

FIG. 15.—Endosternite as seen from above (8 oc. × 7 obj.). The broad transverse piece with its lateral enlargements containing three oval apertures lies in the region between the fifth appendages.



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A Revision of the North American Ants of the Genus Leptothorax Mayr.

By

WILLIAM MORTON WHEELER.

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A REVISION OF THE NORTH AMERICAN ANTS OF THE GENUS LEPTOTHORAX Mayr.[1]

BY WILLIAM MORTON WHEELER.

The diminutive species of the cosmopolitan genus *Leptothorax* are among the most interesting though least conspicuous of our ants. No other group of Formicidæ appears to present such diversity of habits, while at the same time adhering so closely to certain rather definite generic peculiarities. The species all form small colonies, often of not more than twenty-five to fifty individuals, and occupy small cavities in the soil, or between stones, or in the tissues of plants. These cavities are either of their own excavation, or found ready to their use in the form of accidental openings or the burrows and galleries of larvæ, other ants, etc. Favorite nesting-places are the abandoned woody galls of the Cynipidæ, like the galls of *Holcaspis cinerosus* on the live-oaks of central Texas, the galls of Diptera, like *Trypeta solidaginis* on the golden-rod, etc. Even hollow nuts on the ground under the trees are sometimes tenanted by species of *Leptothorax*. Brief notes on the nesting habits, so far as these are known, are appended to the descriptions of the different species enumerated below.

The small size and obscure location of the *Leptothorax* nests, which form a remarkable contrast with the teeming, conspicuous formicaries of other ants like *Formica rufa, F. exsectoides, Pogonomyrmex barbatus* and *Ischnomyrmex Cockerelli,* will readily account for our rather limited knowledge of the North American species. Then, too, none of our *Leptothorax* are really common, except in certain circumscribed localities, so that the discovery of the species is more often a matter of accident than of deliberate search, even when one is out looking for ants and nothing else. Single workers are found running about on the ground or on the trunks and branches of trees in search of sweet exudations, small insects or the remains of large insects that have been rejected by spiders, birds, etc. The nests are most readily found by following up such single workers, often a tedious and time-consuming task, as these insects will sometimes run about for an hour or

[1] Contributions from the Zoological Laboratory of the University of Texas, No. 48.

more in search of food before returning to the nest and revealing its hidden entrance, a tiny hole like a pin-prick in the soil or bark.

None of the species are known to attend aphides, and the nests very rarely or never contain guests or syncœketes of any description. The *Leptothorax* themselves, however, sometimes live as guests in the nests of larger ants. Thus *L. Emersoni* is always found as a guest in the nests of *Myrmica brevinodis*, and *L. acervorum* of Europe and its American variety *convivialis* also exhibit a decided tendency toward xenobiosis. The typical *L. curvispinosus* appears to act as the slave of *Tomognathus americanus*, an extremely rare ant, which is probably similar in habits to its European congener, *T. sublævis*. Most of the species of *Leptothorax* are very timid, and many of them readily "feign death" when roughly handled. Nevertheless they are often extremely hostile and vindictive toward other ants, especially toward ants of their own species from strange nests.

For our first insight into the habits of *Leptothorax* we are indebted to Forel, who recorded his observations in the charming *Fourmis de la Suisse* (pp. 339–341). The more important of these observations are given in the following translation:

"April 17, 1868, I found in the bark of a pine-tree a very small colony of *L. tubero-affinis*, consisting of a fertile female, about a dozen workers and some eggs. I lost four of the workers during the capture and broke two of the legs of the female. I subsequently placed this little family in a pasteboard box with a glass cover. It prospered; the female got on well with her four remaining legs; some of the eggs hatched and the larvæ were fed. The workers would eat nothing but the honey which I gave them; they were very timid and settled down with the female in the box. They gave little heed to the female, which lived almost like them. I have noticed that it is only the workers of the genera *Plagiolepis* and *Lasius* and of certain species of *Formica* that assiduously court their fertile females. *Leptothorax* goes to the opposite extreme: the females live almost like the workers, being merely somewhat less inclined to work. Huber was wrong, therefore, in generalizing the rôle of the fertile females of *Lasius*, etc. By May 24 the female of my captive formicary had again laid some eggs, and the larvæ had grown very large. The workers ate larvæ of *Lasius* that were given to them. June 4 one of the larvæ became a worker pupa, but there remained only two large larvæ and the eggs. June 10 there were two pupæ and eight or nine small larvæ had hatched from the eggs. Of the latter two were yellow and retained this color, the others were whitish. By June 13 they had grown. I then gave my *L.*

tubero-affinis a worker pupa of *L. Nylanderi*, and they took care of it. These ants never attempted to escape when I opened the box. They impressed me by the delicacy of the sense of touch in their antennæ, as they felt of little particles with remarkable precision and distinguished their qualities (one of the eggs of their queen, a grain of dust, a particle of honey, etc.). June 21 I gave them some pupæ of *Tetramorum cæspitum* which they killed and ate. On June 25 *the pupa of L. Nylanderi had hatched, and the resulting worker lived on good terms with the tubero-affinis,* working with them. June 28 I lost several workers through carelessness; there remained only the queen with five worker *tubero-affinis* and the worker *Nylanderi;* the small larvæ had grown considerably and began to pupate. June 29 one of the older pupæ hatched and the other soon followed, so that two worker *tubero-affinis* were added to the colony. The same day I gave my ants worker pupæ of *T. cæspitum.* They cared for two or three of the younger ones and killed the others which were about to hatch, or rather allowed them to die through neglect. July 15 three more small larvæ made their appearance. July 16 *one of the two pupæ of T. cæspitum, which they had continued to foster, hatched and lived thenceforth with these ants of a different genus, on the best of terms.* July 18 the second pupa of *T. cæspitum* followed suit, but this worker was somewhat malformed and died in a week. The first *Tetramorium,* on the contrary, prospered apace; it was larger than any of the *Leptothorax* workers and was conspicuous on account of its activity. It ran about continually in all parts of the box, but kept returning from time to time to the *Leptothorax.* By July 29 a fresh batch of little *tubero-affinis* larvæ had grown up, and the pupæ of the second generation began to hatch. August 16 I placed the seven surviving *tubero-affinis* workers and their queen in alcohol, as the colony had suffered considerably during my trip from Zurich to Vaux. It had lived in captivity four months. . . . .

"June 25, 1868, having found a formicary of *L. acervorum* in the bark of a pine, with a winged female and some female pupæ, I captured and preserved it in a box till August 16. Several females hatched in the box. The females of this species are not larger than the workers. I often saw these little females carrying the larvæ and pupæ about like the workers. Strange to say, nearly all of them lost their wings within two or three days from the time of hatching. I even saw one of them obviously endeavoring to rid herself of her wings by twisting them about. As they were born in a box containing no males, they could not have been fecundated. Hence I cannot conceive why they removed their wings. Can it be that the formicaries of *Leptothorax*

are kept up in this way, because the workers cannot retain the fertile females in the nests by force, on account of the small size of the nests and their position on vertical walls, or because the males may not often be present simultaneously with the winged females? Would not these deälated females be fecundated later by males appearing in the same formicary? The fact remains that one often finds in *Leptothorax* nests deälated females with small abdomens and apparently not fecundated, together with others obviously fertile. I refrain from deciding the question."

The questions asked by Forel so long ago still remain unanswered, although it is clear that the colonies are not as a rule renewed and maintained by a retention of the virgin females in the parental nest. My own observations show that the little colonies of these ants are founded by single fertile females, in the very same manner as the huge formicaries of *Formica, Camponotus*, etc. On several occasions I have found deälated females of *Leptothorax* either alone or with a very few eggs, larvæ or pupæ in isolated oak-galls (*e.g., L. obturator* q. v.). Moreover, I have never found more than one queen in a nest in any of the species that I have taken, except at the very height of the breeding season (May and early June in Texas, mid- or late summer in the Northern States). Although in such nests I have sometimes seen several deälated females, which probably arose as Forel has described, I am inclined to believe that all of these, except the mother queen, must soon leave the nest and establish colonies of their own.

The question naturally suggests itself: Why are the colonies of *Leptothorax* so small? I believe that this peculiar condition may be traced, in part at least, to the following causes, either singly or collectively: 1. The females are but little larger than the workers (in *L. Emersoni* they are not even larger than the workers) and this means relatively small fecundity. This appears to be the case also in other ants that have females of the same or nearly the same size as the workers (*Myrmecina, Stenamma s. str.;* Ponerinæ). And reciprocally, owing to this reduced fecundity, the queen cannot be abundantly fed, since she produces but few workers. 2. The workers of *Leptothorax* are probably short-lived as compared with many other ants. At least one is inclined to believe this from the rather high mortality among these insects in artificial nests. 3. In most species of *Leptothorax* each colony contains only a single fertile queen.[2]

[2] Other observations on the habits of *Leptothorax* will be found in the following works: Adlerz, "Myrmecologiska Studier," II. Svenska Myror och deras Lefnadsförhollanden, *Bihang till K. Svenska Vet. Akad. Handl.*, Bd. XI, No. 18,

The geographical distribution of the North American *Leptothorax*, though very incompletely known, is not altogether devoid of interest. So far as it is possible to generalize from existing data, it would seem that the species are rather uniformly distributed over the entire continent, not excepting at least a portion of the Arctic regions. By this I do not mean to say that the same species occur everywhere, or even that the distribution of a particular species is very wide, but that the ant-fauna of any given locality usually comprises a few species of *Leptothorax*. This indicates a wide range of adaptability to differences of soil, moisture, temperature, vegetation, etc., within the same genus. The extremes of this adaptation seem to be represented by forms like *L. curvispinosus*, which inhabits the humid shady woods of the North Atlantic States, and *L. Pergandei*, which occurs even on the sun-scorched soil of the Trans-Pecos deserts.

We have few species in common with Europe, probably only *L. acervorum* and *L. muscorum*, both presenting distinct American varieties or subspecies analogous to and occurring over the same territory as the American forms of *Formica fusca, rufa* and *sanguinea* and *Myrmica rubra*. All of these forms occur far to the north and to considerable altitudes, both in Europe and America, and undoubtedly constitute important elements of an ancient palæarctic ant-fauna.[3] At low altitudes and within our territory the forms of *L. acervorum* and *muscorum* seem to be confined to the northernmost tier of States.

The twenty species of *Leptothorax* recognized in the present paper as occurring in America north of Mexico are about equally distributed between the two divisions of the genus, which are characterized respectively by the workers and females having 11- (the males 12-) jointed antennæ, and the workers and females having 12- (the males 13-) jointed antennæ. It is an interesting fact that the species with 11-jointed antennæ in the workers are mainly confined to the Northern and Eastern States, those with 12-jointed antennæ to the Western and Southwestern territory. Exceptions are *L. curvispinosus* and *acervorum*, which present varieties even in New Mexico (though at considerable altitudes!) and *L. tricarinatus*, which was described from South

1886, and III. Tomognathus sublævis Mayr, *ibid.*, Bd. XXI, No. 4, 1896; Wheeler, "The Compound and Mixed Nests of American Ants," *Am. Natural.*, Vol. XXXV, Nos. 414, 415, 417 and 418, 1901, and "Ethological Observations on an American Ant (*Leptothorax Emersoni* Wheeler)," *Arch. f. Psych. u. Neurol.*, Bd. II, Heft 1 u. 2, 1903 pp. 1–31.

[3] *L. acervorum* var. *convivialis* (q. v.) has been taken on the summit of Las Vegas Range, N. M., at an altitude of 11,000 feet, by Prof. T. D. A. Cockerell in xenobiosis with another boreal ant, *Myrmica brevinodis*. *L. acervorum* var. *Kincaidi* was described by Pergande from Alaska.

Dakota. All the new species described in the present paper belong to the group with 12-jointed antennæ, and it is probable that many more members of this group remain to be discovered in the West and Southwest. Both groups are represented in Mexico and Central America. To judge from Emery's table of the South American species, those with 11-jointed antennæ predominate again south of the Equator. Most of these species, however, whether having 11- or 12-jointed antennæ, have acute, projecting angles to the pronotum, and are therefore consigned to a particular subgenus, *Goniothorax*, by Emery.[4] The small group comprising the subgenus *Dichothorax* Emery (possibly monotypic) is confined to the Southern United States. This subgenus resembles the subgenus *Temnothorax* Mayr (including only *T. recedens* Nyl.) in many respects. It is interesting to note that this form occurs only in Southern Europe.

While some of the European *Leptothorax* (like *tuberum* and *unifasciatus*) are known to be extremely variable, the North American materials at the disposal of previous writers have not been sufficient to prove the same for any of the species on this side of the Atlantic. Nor am I able to throw as much light as I could wish on the limits of variability in our species, although my material certainly shows that some of our species are decidedly unstable. Such are, *e.g.*, *L. acervorum*, *curvispinosus*, *nitens* and possibly also *Schaumi* and *fortinodis*, especially if the two latter really represent extreme forms of the same species, as seems to be indicated by the existence of intermediate forms.

The genus *Leptothorax* was established by Mayr in 1855,[5] on a number of species previously included by Nylander and other myrmecologists in the composite genus *Myrmica*, a genus which at one time contained practically all the known ants of the subfamily Myrmicinæ. Though some of the characters of *Leptothorax* are not very definite, the genus has nevertheless stood the test of nearly half a century and will probably continue to stand. Like many ant-genera, and genera of other animals also, for that matter, it is recognized not so much by a description of its characters, as by its peculiar and almost unmistakable habitus. He who has had little experience in handling ants will be liable to confound the workers of *Leptothorax* with the workers of *Pheidole* or *vice versa*, but to the experienced eye even the gait of the

[4] "Studi sulle Formiche della Fauna Neotropica," *Bull. Soc. Ent. Ital. Ann.*, XXVIII, 1896, pp. 26, 27.

[5] "Formicina Austriaca," *Verh. K. K. zool.-bot. Ver. Wien*, Bd. 5, 1855, pp 431–433.

ants of these two genera differs very decidedly. The following are the leading diagnostic characters of the genus *Leptothorax*.

LEPTOTHORAX Mayr.

Worker.—Small, monomorphic. Head longer than broad, and broader than the thorax. Mandibles broad, 4–5-toothed. Maxillary palpi 5-jointed; labial palpi 3-jointed. Clypeus variable in shape, slightly convex or impressed in the middle, its anterior border somewhat rounded, entire or sinuately excised in the middle. Frontal carinæ almost straight, diverging very little behind. Antennæ 11- or 12-jointed, usually with a distinctly 3-jointed club. Frontal area present. Eyes of moderate size, near the middle of the lateral surface of the head. Ocelli occasionally present, especially in ergatoid or subergatoid individuals. Thorax slender, usually somewhat broader in front, at least above, and narrower behind. Promesonotal suture obsolete; mesoëpinotal suture present or absent, the thorax at this region either without any constriction, with a faint or a very decided (subgen. *Dichothorax*) constriction. Epinotum armed with a pair of teeth, or spines of variable development. Petiole with a short peduncle in front and surmounted by a node of variable form, its lower anterior surface armed with a median tooth. Postpetiole nodiform, sometimes more campanulate, unarmed below. Gaster large, broadly elliptical, compressed dorsoventrally, its basal three-fourths formed by the first segment. Sting well developed, at least in many of the species. Legs rather stout, the femora fusiform, somewhat incrassated in the middle, the tibiæ thicker toward their distal ends. Spurs of middle and hind legs simple, not pectinate. Integument very hard. In most species the hairs on the body, and in a few also those on the appendages, are short, erect, clavate and under a high magnification finely crenulate. Our species are yellow, brown, red or black, and the majority of them have the head, thorax and pedicel more or less sculptured and in great part opaque. The gaster in all our species is very smooth and shining.

Female.—Somewhat larger and more robust than the worker, or of the same size. Antennæ of the same number of joints. Eyes and ocelli moderately prominent. Thorax with its sides subparallel or somewhat bulging in the middle. Mesonotum conspicuously flattened. Epinotal spines shorter and often stouter than in the worker. Basal surface of epinotum nearly horizontal. Petiole and postpetiole like the corresponding segments of the worker, the node of the former often more acute. Gaster like that of the worker, at least its basal two-

thirds formed by the first segment. Wings milky or yellowish hyaline, with very pale and indistinct veins and stigma. Radial cell sometimes open, sometimes closed. There is a single cubital cell. Transverse vein meeting cubital vein at its bifurcation; internal cubital often indistinct. Discal cell closed. The pilosity of the female is usually less pronounced than that of the worker, though of the same character; the sculpturing is rougher.

Male.—Of the same size as the worker, or but little larger, and usually darker in color. Head short and as broad or broader than the thorax. Mandibles variable, narrow, truncate and toothless, or dentate or denticulate. Clypeus somewhat convex. Antennæ 12–13-jointed; scape short, funiculus very long, slightly thickened at its distal end to form, in many cases, an indistinct 4-jointed club. Eyes and ocelli large and prominent. Mayrian furrows of mesonotum very distinct. Epinotum not prolonged backward, with two small swellings, rarely with two short teeth, in the place of the worker armature. Petiole more slender and with lower node than in the worker. Postpetiole nodiform or subcampanulate. Gaster rather slender, elongate elliptical, often slightly flattened dorsoventrally. Legs slender. Wings as in the female. Hairs on the body and appendages usually much less conspicuous than in the worker, not clavate.

I subjoin a table for the identification of the workers of the various *Leptothorax* species known to occur in America north of Mexico. As the females of only half and the males of less than half of our species are known, it is hardly worth while to construct tables for the identification of the winged sexes.[6]

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[6] The following species have been described from Mexico and Central America, and in all probability comprise but a very small portion of the species actually occurring in these countries:

1. *Leptothorax Stolli* Forel, Bull. Soc. Vaud. Sci. Nat. (2), XX, p. 352, 1894. ♂ ☿ ; Dalla Torre, Cat. Hymenopt., VII, 1893, p. 127; Forel, Biol. Centr. Am., III, 1899, p 54. ♀.
   Guatemala, summit of crater of the Volcan de Agua (13,000 feet!); living under stones.
2. *L. echinatinodis* Forel, Compt. Rend. Soc. Ent. Belg., XXX, 1886, p. xlviii. ☿ ; Biol. Centr. Am., III, 1899, p. 55.
   Rio Janeiro, Brazil. Lives in hollow twigs. The typical form has not been found in North America, but only the following subspecies and possibly its variety:
   Subsp. *aculeatinodis* Emery, Bull. Soc. Ent. Ital., XXVIII, 1896, p. 60. ☿.
   Costa Rica, Jimenez. Also Brazil.
   Var. *pungentinodis* Emery, Bull. Mus. Zool. Torino, XI, 1896, p. 2. ♀.
   Mexico, Atoyac en Vera Cruz; Panama.
3. *L. Pittieri* Forel, Biol. Centr. Am., III, 1899, p. 56. ☿. Costa Rica.
4. *L. Tristani* Emery, Bull. Soc. Ent. Ital., XXVIII, 1896, p. 61. ☿ ♀. Forel, Biol. Centr. Am., III, 1899, p. 56 Jimenez, Costa Rica.

Table for the identification of the workers of Leptothorax.

1. Antennæ 11-jointed, ... 2
   Antennæ 12-jointed, ... 10
2. Thorax with faint but distinct mesoëpinotal constriction, ... 3
   Thorax without mesoëpinotal constriction, ... 7
3. Postpetiole sculptured, opaque, ... 4
   Postpetiole smooth and shining above, ... 6
4. Tibiæ and antennal scape without clavate hairs, ... 5
   Tibiæ and antennal scape with short, erect, clavate hairs, *L. hirticornis* Emery.
5. Hairs on body long and thin, not clavate, *muscorum* Nyl. var. *sordidus* var. nov.
   Hairs on body short and clavate, *acervorum* Mayr. subsp. *canadensis* Prov., etc.
6. Tibiæ with clavate hairs, ... *Provancheri* Emery.
   Tibiæ without clavate hairs, ... *Emersoni* Wheeler.
7. Epinotal spines very short, dentiform, ... 8
   Epinotal spines long, ... 9
8. Petiole not conspicuously larger in profile than the postpetiole, *Schaumi* Roger.
   Petiole conspicuously larger in profile than the postpetiole, *fortinodis* Mayr. (and its varieties).
9. Dark-colored, with very long, horizontal epinotal spines, *longispinosus* Roger.
   Yellow, sometimes more or less infuscated; epinotal spines shorter, *curvispinosus* Mayr. (and its subspecies and varieties).
10. Without mesoëpinotal constriction; hairs on body clavate, not abundant, 11
    With pronounced mesoëpinotal constriction, hairs abundant, not clavate (subgenus *Dichothorax* Emery), ... 19
11. Head very largely smooth and shining, ... 12
    Head opaque or subopaque, or smooth only along the median line or behind, ... 13
12. Very dark-brown, or black, antennal scape almost reaching the posterior angle of the head, ... *Schmittii* sp. nov.
    Yellow, or somewhat infuscated; scape reaching to ⅔ the distance between the eye and the posterior corner of the head, ... *nitens* Emery (and its subspecies and variety).
13. Anterior margin of clypeus entire, rounded, ... 14
    Anterior margin of clypeus sinuately excised, ... 16
14. Head and thorax very coarsely reticulate-rugose, . . . *texanus* sp. nov.
    Head and thorax not coarsely reticulate-rugose, ... 15
15. Clypeus produced, with angularly projecting anterior border, *tricarinatus* Emery.
    Clypeus not produced, with broadly rounded anterior border, *neomexicanus* sp. nov.
16. Black or dark-brown species, ... 17
    Yellow species, ... 18

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[15] *L. petiolatus* Forel, Ann. Soc. Ent. Belg., XLV, 1901, p. 129. ☿. Wheeler, Ann. Soc. Ent. Belg., XLV, 1901, p. 201.

Cuernavaca, Mexico. "A single nest, consisting of a deälated queen and about 25 workers in a Tillandsia in parabiosis with *Cryptocerus* and *Cremastogaster*."

17. Petiole slender, seen from above three times as long as broad, node very low and rounded, ... *obturator* sp. nov.
Petiole only 1½ times as long as broad; node higher and shorter, *nevadensis* sp. nov.

18. Head opaque throughout, petiolar node round in profile; length 1.5–1.75 mm., *terrigena* sp. nov.
Head with a smooth median line, node of petiole somewhat angular; length 2.25, ... *Andrei* Emery.

19. Summit of petiolar node seen from behind impressed or concave, *Pergandei* Emery.
Summit of petiolar node seen from behind convex, rounded, *floridanus* Emery.

1. Leptothorax hirticornis Emery.

L. hirticornis Emery, Zool. Jahrb. Abth. f. Syst., VIII, 1894, pp. 317 and 319. ☿.

Worker.—Length 2.75 mm.

Clypeus hardly impressed in the middle. Antennæ 11-jointed, joints 2–7 of the funiculus shorter than broad, club but relatively little thickened. Thorax slender, distinctly impressed at the mesoëpinotal suture. Epinotal spines of average size, pointed, strongly compressed. Petiole robust, its anterior and posterior dorsal slopes forming a slightly obtuse angle; seen from above the sides of the petiole are subparallel. Postpetiole small, almost trapezoidal, a little broader than long.

Clypeus somewhat shining. Head, thorax and pedicel opaque, densely foveolate-punctate, the upper surface of the head also finely and rather regularly longitudinally rugose.

Hairs very short, strongly clavate, erect, not only covering the body but also the antennal scape and legs.

Bright testaceo-ferruginous, gaster and middle of front infuscated.

Type locality: Washington., D C. (Pergande).

Described from a single specimen in the collection of Prof. Emery.

2. Leptothorax muscorum Nylander, var. **sordidus** var. nov.

L. muscorum Emery, Zool. Jahrb. Abth. f. Syst., VIII, 1894, p. 318. ☿.

Worker (Pl. XII, fig. 2).—Length 2–2.75 mm.

Clypeus not impressed in the middle, its anterior border nearly straight, not produced. Antennæ 11-jointed; scape reaching to midway between the eye and the posterior angle of the head; first funicular joint as long as joints 2–4 together, terminal joint as long as the two preceding joints of the club. Thorax broad in front, with rounded humeri, much narrower behind, with a distinct mesoëpinotal constriction. Epinotal spines of moderate length, directed backward, and slightly outward, about as far apart at their bases as they are long. Petiole from above suboblong, with slightly convex sides, nearly

twice as long as broad; in profile the anterior and posterior slopes of the node are of nearly equal length, the former slightly concave, the latter distinctly convex, the apex somewhat flattened. Postpetiole hardly more than half as long as the petiole, but half again as broad, with prominent, rounded anterior angles and convex node.

Head subopaque, longitudinally reticulate rugose, mandibles and frontal area smooth, clypeus with several longitudinal rugæ, which are so delicate as to leave the surface shining. Thorax subopaque, irregularly reticulate rugose, especially on the pronotum and epinotum, the neck and pleuræ still more delicately reticulate. Petiole and postpetiole subopaque, delicately reticulate rugose. Gaster smooth and shining.

Hairs on the head and trunk whitish, rigid and obtuse, but hardly clavate, longest and most conspicuous on the abdomen. Antennæ and legs clothed with delicate, appressed, whitish hairs.

Color yellow, whole head, except the mandibles, dark-brown. There is a large brown blotch on the pronotum and one on the epinotum. Nodes of petiole and postpetiole, trochanters, swollen portions of the femora, club of antennæ and the dorsal surface of the gaster distinctly infuscated.

Type locality: Boulder, Colo.

Described from a dozen specimens received from Rev. P. J. Schmitt, O.S.B.

This variety appears to be identical with the form mentioned by Emery from Hill City, S. Dak. (Pergande). It differs from specimens of the typical European *muscorum*, sent me by Prof. Forel from the Schluderbach, Switzerland, in the following points: Hairs on the trunk distinctly shorter and at least on the head, thorax and pedicel distinctly thicker. Dorsal portions of thorax and pedicel and the thickened portions of the femora infuscated. These characters are constant in the twelve Colorado specimens.

3. Leptothorax acervorum Mayr, subs. **canadensis** Provancher.

L. canadensis Provancher. Addit. Faun. Canada, Hyménopt., 1887, p 245. ☿♀♂.

L. acervorum var. *canadensis* Er. André, Rev. d'Entomol., VI, 1887, p. 295. ☿.

L. acervorum var. *canadensis* Dalla Torre, Catal. Hymenopt., VII, 1893, p. 123.

L. canadensis Emery, Zool. Jahrb. Abth. f. Syst., VIII. 1894, pp. 317, 318, 319.

Worker (Pl. XII, fig. 4).—Length 2.75–3.5 mm.

Minute ocelli occasionally present. Clypeus with a distinct longitudinal impression in the middle, its anterior border rather convex and

rounded. Antennæ 11-jointed; scape reaching midway between the eye and the posterior angle of the head; first funicular joint not longer than joints 2–3 together; terminal joint distinctly longer than the two preceding joints of the club. Thorax long, subcylindrical, somewhat narrowed behind, dorsally flattened, its anterior angles rounded; promesonotal and mesoëpinotal sutures both distinct, a slight but distinct constriction at the latter. Epinotal spines rather short and blunt, compressed, in many specimens tooth-like and hardly longer than broad at the base, directed backward in a line with the dorsal surface of the epinotum, in no case longer than their distance apart at the base. Petiole from above oblong, not more than 1½ times as long as broad, the node in profile with evenly concave anterior and somewhat depressed but convex posterior slope. Postpetiole trapezoidal, distinctly broader than long, its anterior angles prominent, anterior border distinctly broader than the posterior, dorsal surface hemispherical in profile.

Mandibles shining, coarsely punctate. Median impressed surface of clypeus smooth and shining, lateral surfaces longitudinally rugose. Head opaque, longitudinally reticulate rugose, the rugæ being most distinctly longitudinal on the front, vertex and cheeks. Thorax opaque, covered with reticulate rugæ which have a decidedly longitudinal trend on the dorsal and lateral surfaces of the pronotum and on the dorsal surface of the epinotum and the mesopleuræ. On the mesonotum the reticulation resolves itself into an area of even, close-set foveolæ. Pedicel opaque, the petiole sculptured like the mesonotum, the postpetiole somewhat smoother and almost punctate. Gaster smooth and shining.

Hairs whitish; those on the head, thorax and pedicel short, rigid and subclavate, on the gaster longer and thinner; on the antennæ and legs delicate, appressed.

Color dark-brown, almost black; small joints of the funiculus, the metatarsi, bases of femora, trochanters, ventral surface of pedicel, and in many specimens also the sutural regions of the thorax, yellow or pale-brown. In some specimens (immature?) nearly the whole thorax and the whole of the tibiæ are yellow.

Female (deälated).—Length 3.75–4 mm.

Apart from the distinctively sexual characters, the female differs from the worker in the following characters: The reticulate rugosity of the head is more decidedly longitudinal, the rugæ running back regularly to the occiput without deviation at the ocellar region. Mesonotum, scutellum and pleuræ traversed by distinct longitudinal rugæ,

the first somewhat shining in the middle near its anterior border and in the regions of the parapsidal furrows. On the epinotum, about the bases of the spines, the rugæ become very coarse and reticulate. Epinotal spines short and blunt, resembling those of the worker in shape and direction. Petiolar node pointed, with rather flat anterior and posterior slopes, coarsely reticulate rugose. Sculpture of postpetiole less pronounced than that of the petiole, but coarser than the petiole of the worker. Pilosity short, like that of the worker, but the hairs on the head, thorax and pedicel are less clavate. Head, thorax, abdomen, femora and antennal club, black, remaining portions of the legs and the funicle, brown.

Type locality: "Canada."

Additional localities: Elk county, Pa. (Bradley); Olympia, Wash. (Kincaid).

This form should, I believe, be regarded as belonging to the same species as the European *acervorum*, as suggested by André. As Emery claimed, however, it deserves to rank as a subspecies, and not as a variety. The workers differ from the European specimens of *acervorum* in my collection (from Switzerland (Forel) and Scotland (Duglich)) in the shorter epinotal spines, the much deeper coloration of the thorax, pedicel and legs, the shorter and more clavate hairs on the trunk and the minute, appressed, instead of suberect hairs on the antennal scapes and legs. My specimens of the North American form average nearly as large as the European.

This subspecies is certainly rare in the Eastern States, but seems to be very common in Washington, to judge from the number of different nests sent me from that state by Prof. Kincaid. This is probably significant in connection with the palearctic distribution of *acervorum*.

The habits of the American subspecies are unknown. They probably resemble those of the European form, which lives in small colonies under bark, in moss, etc.

3a. Var. yankee Emery.

L. canadensis Prov. var. *yankee*, Zool. Jahrb., VIII, '94, p. 319. ☿ ♀.

The worker (fig. 5) differs from the worker of *canadensis typ.* in lighter coloration and in having somewhat longer epinotal spines. Head dark-brown, gaster somewhat paler; mouth, thorax, pedicel and legs reddish; antennal club, thoracic dorsum and femora usually infuscated. Sculpture finer and less rugose than in *canadensis*. In the female the thorax is dark-brown, the sculpture more pronounced.

Type localities: South Dakota, Utah, Colorado.

Several workers sent me by Rev. P. J. Schmitt, O.S.B., from Boulder, Colo., agree very well with Emery's description.

3b. Var. convivialis var. nov.

Length of worker 2–2.5 mm.; of female 3 mm. Differs from the typical *canadensis* and the preceding variety, in its small size and very deep coloration. Head, thorax, abdomen, femora and tibiæ black, neck, ventral portions of pedicel, funiculus, trochanters, knees and tarsi red or yellow. Epinotal spines short and blunt. Sculpturing of body as rough as that of the typical *canadensis*. Color of the female deeper than that of the worker, the shining region of the mesonotum is more extensive than in the female of *canadensis*, and there is a large shining area devoid of sculpture in the middle of the scutellum.

Type locality: Milwaukee, Wis.

Additional localities: Colebrook, Conn.; top of Las Vegas Range (11,000 feet), N. M. (T. D. A. Cockerell); Beulah, N. M. (F. W. P. Cockerell).

This variety seems to have a pronounced tendency to symbiosis with other species of Myrmicidæ. The Milwaukee specimens were found living in the bark of a stump in xenobiosis with *Cremastogaster lineolata* Say. Those from the top of the Las Vegas Range were taken by Prof. Cockerell in a nest of *Myrmica brevinodis*. The Connecticut specimens appeared to be living in plesiobiosis with *Formica rufa* subsp. *difficilis* Emery.

3c. Var. Kincaidi Pergande.

L. Yankee Emery var. *Kincaidi* Pergande, Proceed. Wash. Acad. Sci., Vol. II, December 20, 1900, pp. 520, 521. ☿♀.

"*Female.*—Length about 4 mm.

"Head and thorax black, the abdomen dark-brown, with the posterior edge of the segments brownish-yellow; antennæ, mandibles and legs yellowish-red, the neck and paler parts of the nodes of a darker red; the flagellum grows gradually darker toward the end, with the last joint black; femora dark-brown, their base and apex yellowish-red; teeth of mandibles black. Head finely striated, the striæ most distinct in front of the eyes and between the frontal carinæ; the posterior half of the head is finely and rather densely rugose or reticulate, the clypeus is almost smooth and the mandibles striato-punctate; pronotum and mesonotum quite coarsely rugose, the metanotum, scutellum and upper surface of nodes finely, though rather indistinctly, striated; declivity of the metathorax transversely striated. Abdomen smooth. Erect hairs short, truncate and pale-yellowish, those of the nodes and abdomen longest; there are also a few much finer, erect hairs on the femora.

"The female resembles somewhat that of *L. yankee*, which, however, is somewhat smaller, the last antennal joint and metanotal spines shorter, the hairs of the abdomen much finer and the erect hairs of the femora wanting.

"*Worker*.—Length about 3 mm.

"Head and teeth of mandibles black, the abdomen dark-brown; antennæ, mandibles, thorax, legs and nodes reddish-yellow; coloration of the last three or four joints of the antennæ and the femora as in the female, the upper surface of the thorax and nodes more or less decidedly reddish-brown. Striation of the head more distinct than in the female, and the space between the striæ more or less distinctly reticulated, particularly so toward the sides. Pronotum and mesonotum and the nodes finely rugose; sculpturing of the metanotum slightly coarser. Abdomen smooth; all the hairs similar to those of the female.

"The worker is very similar in appearance to those of *L. yankee*, though somewhat larger, more robust, the sculpturing coarser and the hairs stouter."

Type locality: Metlakahtla, Alaska (June). Cat. No. 5,278 U. S. National Museum.

Described from one female and twelve workers.

4. Leptothorax Provancheri Emery.

Myrmica tuberum Provancher, Natur. Canad., V, 12, 1881, p. 3592. Faune Entom. Canad., Hyménopt., 1883, p. 602. ♀.
Leptothorax Provancheri Emery, Zool. Jahrb. Abth. f. Syst., VIII, 1894, pp. 317 and 320. ♀.

Worker.—Length 2.75 mm.

Body robust. Antennæ 11-jointed. Thorax stout, impressed at the mesoëpinotal suture. Epinotal spines short, tooth-like, resembling those of *L. canadensis* var. *yankee*. Petiole with subparallel sides, node angulate above. Postpetiole about half again as broad as the petiole, transversely elliptical.

Opaque, rugose-punctate; sculpturing like that of *acervorum*, the rugæ on the head less numerous, forming wide meshes. Postpetiole very smooth and shining, with a few piligerous punctures, but otherwise impunctate. Gaster smooth and shining, with short longitudinal striæ at its extreme base.

Hairs rather long, clavate, both on the body and on the tibiæ.

Testaceous, crown of head infuscated.

Type locality: "Canada" (Provancher).

Redescribed by Emery from a single specimen, Provancher's original description being inadequate for the identification of the species.

5. Leptothorax Emersoni Wheeler.

L. Emersoni Wheeler, Am. Natural., XXXV, 1901, pp. 433–436. ☿♂♀.

Worker (Pl. XII, fig. 6).—Length 2.5–3.3 mm.

Head rather convex above, excluding the mandibles not much longer than broad, sides rounded, posterior margin very faintly excised in the middle. Eyes rather large, convex, in the middle of the lateral surface of the head. Ocelli often present. Clypeus large, convex, broadly rounded in front. Mandibles 6-toothed. Antennæ 11-jointed, scape reaching nearly to the posterior angle of the head; first funicular joint but little longer than the second and third joints together; terminal joint not quite as long as joints 7–9 of the funiculus. Thorax rather long, rounded in front, narrowed behind, with distinct promesonotal and mesoëpinotal sutures, the thorax distinctly constricted at the latter. Epinotal spines short, blunt, compressed, hardly longer than broad at their bases, directed somewhat upward and backward, their distance apart at the base greater than their length. Petiole from above oblong, 1½ times as long as broad, sides slightly convex just in front of the middle; in profile the node is pointed, with distinctly concave anterior and posterior slopes. In some specimens, however, the posterior slope is straight or even somewhat convex. Ventral portion compressed, produced forward as a blunt projection. Postpetiole campanulate, with evenly convex dorsal surface; seen from above it is nearly twice as broad as the petiole, its anterior portion evenly rounded, not angulate. Gaster rather large, of the usual shape, without distinct anterior angles.

Head opaque. Mandibles coarsely punctate. Clypeus smooth in the middle, with a few longitudinal rugæ on either side. Head traversed by coarse longitudinal and occasionally anastomosing rugæ; interrugal spaces coarsely and more or less confluently foveolate-punctate. Around the eyes the rugæ become more reticulate, though they still have a distinctly longitudinal trend on the cheeks and lower surface of the head. Thorax opaque, its dorsal surface resembling the head in sculpture, except that the rugæ are more reticulate and without longitudinal trend. On the pleuræ the rugæ become indistinct and are replaced by even and closely aggregated foveolæ. Petiole opaque, sculptured like the pleuræ. Postpetiole smooth and shining above, delicately reticulate under a high magnification, especially on the sides. Gaster very glabrous and shining.

Whole body, including the legs and antennæ, abundantly beset with rather long, suberect, whitish hairs, which on the trunk are obtuse but by no means clavate. Hairs on the gaster longest and most regularly arranged.

Yellow or reddish-yellow, dorsal surface of head, terminal half of funiculus and the gaster, with the exception of the anterior, lateral and posterior borders of the segments, both on the dorsal and ventral surfaces, black or dark-brown.

Female.—Length 2.5–3.5 mm.

Like the worker. Thoracic dorsum dark-brown, rather shining; mesonotum and scutellum traversed by distinct, rather widely separated, longitudinal rugæ; pronotum and epinotum coarsely reticulate rugose, the rugæ of the latter being continued up onto the dorsal and lateral surfaces of the stout, blunt spines. Pleuræ subopaque, coarsely reticulate rugose, the meshes being occupied by aggregated shallow foveolæ. Node of petiole somewhat more acute than that of the worker. Wings grayish hyaline, veins and stigma dirty yellowish.

Male.—Length 2.5–3 mm.

Mandibles very small, not distinctly dentate and far from meeting each other with their blades. Antennæ 12-jointed; scape hardly as long as the three first joints of the funiculus together, first funicular joint very short, the others cylindrical, of uniform thickness but increasing gradually in length toward the tip. Parapsidal and other thoracic sutures very distinct. Epinotum with two very short rugose projections in the place of the spines. Petiolar node low, rounded, its anterior slope slightly concave, its posterior slope shorter and convex. Postpetiole hemispherical. Gaster somewhat less flattened and narrower than in the worker.

Mandibles striated. Clypeus even in the middle with a few delicate longitudinal rugæ. Head above longitudinally reticulate rugose; rugæ radiating backward and laterally from the posterior ocelli as centers. Thorax rather smooth, indistinctly punctate. Pedicel and gaster glabrous.

Hairs almost completely absent on the head and thorax, short and inconspicuous on the legs, long on the pedicel and gaster, but nowhere truncated at their tips.

Brownish-yellow like the worker. Head, thoracic dorsum, pedicel and gaster, and the middle portions of the femora and tibiæ somewhat darker. Wings as in the female.

Type locality: Colebrook, Litchfield county, Conn. Males and females appearing in August.

This species always lives in xenobiosis with a larger Myrmicine ant (*Myrmica brevinodis* Emery) in the hummocks of moss (*Polytrichum commune*), under stones, bits of wood, etc., in rather damp, grassy bogs. The *Leptothorax* occupy separate nests, which, however, com-

municate by means of narrow passages with the galleries and chambers of the *Myrmica*. They obtain their food by licking the surfaces of the *Myrmica* and by regurgitation. All sorts of transitional forms occur between the workers and queens (ergatoids and macroërgates with from one to three ocelli).

6. Leptothorax Schaumi Roger.

L. Schaumi Roger, Berl. Ent. Zeitschr., VII, 1863, p. 180, No. 70. ☿.
L. Schaumi Mayr, Verh. Zool. bot. Ges. Wien, XXXVI, 1886, p. 451. ♂.
L. Schaumii Dalla Torre, Catalog Hymenopt., VII, 1893, p. 127.
L. Schaumi Emery, Zool. Jahrb. Abth. f. Syst., VIII, 1894, p. 320.

Worker (Pl. XII, fig. 7).—Length 2.5–2.75 mm,

Mandibles 5-toothed. Clypeus convex without median impression; its anterior border rather straight. Antennæ 11-jointed; scape reaching hardly to half way between the eye and the posterior angle of the head, funiculus with a distinctly 3-jointed club; first funicular joint almost as long as joints 2–5 together; joints 2–7 distinctly broader than long; terminal joint fully as long as the two preceding joints. Thorax rather short, flattened dorsally and laterally, broader in front than behind, with distinct and rather sharp humeral angles, and with a constriction at the mesoëpinotal suture. Epinotal spines very short dentiform, not longer than broad at their bases. Petiole seen from above oblong, 1½ times as long as broad, its sides parallel except at the peduncle which is narrower; in profile the anterior dorsal slope is concave and about the same length as the straight or somewhat convex posterior slope; ventral surface with a distinct tooth directed forward. Postpetiole scarcely half again as broad as the petiole, distinctly broader than long, oblong, with distinct though rounded anterior angles. Its dorsal surface is evenly semicircular in profile. Gaster of the usual shape, with small but distinct anterior angles.

Clypeus with sharp longitudinal rugæ, two of which, near the middle, are more prominent than the others. Mandibles with distinct longitudinal rugæ. Head, clypeus and mandibles with a silky luster, the first traversed by fine parallel rugæ separated by rows of foveolate punctures, which are clearest in certain lights on the posterior lateral surfaces and cheeks. Thorax, petiole and postpetiole opaque, covered uniformly with foveolate punctures. Gaster smooth and shining.

Hairs moderately numerous on the body, white, erect, clavate; short on the head and thorax, much longer on the gaster and of intermediate length on the pedicel. Hairs on the antennæ and legs minute, non-clavate, appressed.

Yellowish-red, the edges of the mandibles black. Gaster in some specimens dark-brown throughout, in others yellow or with much of

the base of the first segment yellow. Antennæ and legs yellow, club and sometimes also the scape of the former, infuscated.

Male.—Length 3.2 mm.

Mandibles dentate, touching each other with their blades. Antennæ 12-jointed, scape about as long as the first three joints of the funiculus together; funiculus from the second joint to the end of uniform thickness, filiform; second joint a little shorter than the third, shorter, in fact, than any of the succeeding joints. Instead of spines or teeth, the epinotum bears two indistinct elongate swellings. Radial cell of wings short and closed.

Mandibles rather smooth and shining, with scattered punctures near their inner edges. Clypeus moderately shining and very delicately longitudinally rugose. Cheeks and region between antennal insertions and eyes sharply striated longitudinally; front with delicate longitudinal rugæ; vertex finely reticulate punctate. Thorax rather smooth and shining, median and posterior portions of mesonotum finely longitudinally rugose and in part obliquely. Petiole, postpetiole and gaster smooth and shining.

Pilosity sparse, tibiæ without suberect hairs.

Blackish-brown, pedicel and gaster darker. Mandibles, antennæ except the brown scape, joints of legs, tarsi, and in part also the joints of the pedicel, yellow or reddish-yellow. Wings clear, hyaline.

Type locality: "Pennsylvania" (Schaum).

Additional localities: District of Columbia (Pergande); Beatty, Pa. (Schmitt); Westville, N. J. (Schmitt); Austin, Tex.

In the locality last mentioned I have occasionally taken the workers of *L. Schaumi* running on the bark of large willows (*Salix nigra*).

7. Leptothorax fortinodis Mayr.

L. fortinodis Mayr, Ver. Zool. bot. Ges. Wien, XXXVI, 1886, pp. 451, 452. ♀ ☿.
L. fortinodis Dalla Torre, Catalog. Hymenopt., VII, 1893, p. 124.
L. fortinodis Emery, Zool. Jahrb. Abth. f. Syst., VIII, 1894, pp. 318, 321.

Worker (Pl. XII, fig. 8).—Length 2.5–3 mm.

Head somewhat longer than broad, sides subparallel, occipital border nearly straight. Eyes moderately large and convex. Mandibles 5-toothed. Clypeus convex, its anterior border broad and rounded. Antennæ 11-jointed; scape reaching to midway between the eye and the posterior angle of the head; funiculus terminating in a 3-jointed club; first funicular joint as long as joints 2–4 together; joints 2–5 broader than long, 6 and 7 as long as broad; terminal joint somewhat

longer than the two preceding joints of the club. Thorax moderately long, its dorsal and pleural surfaces flattened; humeral angles prominent and rather sharp; no constriction between the meso- and epinotum. Epinotal spines very short, not longer than broad at their bases, turned upward. Pedicel rather robust; petiole oblong when seen from above, almost twice as long as broad; sides of the nodal portion nearly parallel, peduncle narrower; in profile the anterior slope is distinctly concave, the posterior strongly convex, the apex of the node rounded; anterior ventral surface with a prominent tooth, directed forward and downward. Postpetiole but little broader than the petiole; nearly as long as broad, subglobose, strongly arched dorsally, its anterior about as broad as its posterior border, the anterior angles rounded, hardly distinct. Gaster of the usual configuration, with small but prominent basal angles. Legs robust.

Mandibles and clypeus longitudinally rugose, the former finely and indistinctly, the latter more coarsely and distinctly. Head opaque, except the crown and occiput which are more or less shining or lustrous, covered with foveolate punctures, in addition to which the front and crown are finely longitudinally rugose, the cheeks and sides reticulate-rugose, the lower surface more indistinctly reticulate. Thorax, petiole and postpetiole opaque, or slightly lustrous, densely and evenly foveolate-punctate. Gaster smooth and shining.

Hairs on the body yellowish-white; erect and clavate on the head, thorax and abdomen; longest on the gaster; on the antennæ and legs the hairs are minute, tapering and appressed.

Head, thorax and pedicel deep reddish-brown, gaster almost or quite black; mandibles, antennæ and legs red, club of antennæ and often also the femora infuscated.

Female (deälated).—Length 3.5–4 mm.

Like the worker in coloration, except that the anterior and lateral portion of the mesonotum, the epinotum and dorsal surfaces of the petiolar and postpetiolar nodes may be distinctly infuscated. Whole upper surface of head longitudinally rugose, the rugæ diverging to the corners of the head in the postocellar region. Mesonotum and scutellum traversed by numerous parallel longitudinal rugæ, which are finer than those on the head; pronotum finely reticulate, median portion of scutellum smooth and shining; pleuræ reticulate-punctate, rather rough, the rugæ somewhat longitudinal in direction. Epinotal spines very small and tooth-like, rather blunt; the region between and below them densely foveolate-punctate. Petiole with less convex

anterior slope to the node; postpetiole relatively shorter and broader than in the worker.

Type locality: Maryland.

Additional locality: Austin, Tex.

The specimens from Austin have the head, thorax and pedicel decidedly paler in color than a type specimen received from Dr. Mayr and three topotypes given me by Mr. Pergande; the petiole is relatively smaller and there is a clavate hair at the base of each epinotal spine as in *Schaumi*. This hair is lacking in my types of *fortinodis*, possibly because these are much rubbed.

I have found only a single colony of this form at Austin. This had taken up its abode in an abandoned gall of *Holcaspis cinerosus* Basset on the live-oak (*Quercus virginiana*). It contained 143 workers, a single deälated queen and 35 larvæ in different stages. The latter were white and not greenish like the larvæ of *L. obturator* which inhabits the same kind of galls. The entrance to the *fortinodis* nest was a small round hole with much worn edges, evidently the modified exit of some parasite on the *Holcaspis*.

7a. Var. melanoticus var. nov.

Worker.—Length 2–2.5 mm.

This form is decidedly smaller and much deeper in color than the typical *fortinodis*. Whole body black, petiole and postpetiole brownish behind and below; mandibles, joints of legs, tarsi and funiculus brown. Epinotal spines very short and blunt in some specimens, in others acute and longer, recalling the conditions described by Mayr for a small variety of *fortinodis* from the District of Columbia.

Female (deälated).—Length 2.9–3 mm.

Decidedly smaller than the typical form, head and thorax as well as the pedicel and gaster black; the ventral surface of the petiole and postpetiole reddish. Legs dark-brown or black; coxæ, knees, tarsi and basal portion of funiculus somewhat paler.

Type locality: Rockford, Ill.

The workers of this apparently somewhat depauperate form are sometimes seen running on the bark of large prostrate oak logs in the woods. They inhabit small flat chambers only $\frac{1}{2}$ to $\frac{3}{4}$ inch in diameter excavated in the thick corky bark. Each nest contains a single deälated queen and a comparatively small number of workers (about 25 to 40).

7b. Var. gilvus var. nov.

Worker.—Length 2.25 mm.

Differs from the typical *fortinodis* in the color, which is throughout

a clear yellow, and in the sculpturing of the head, which is smooth and shining except on the sides, where it is more opaque and reticulate. The vertex is traversed by a few rather widely separated rugæ.

Female (deälated).—Length 4 mm.

Differs like the worker in coloration. The whole body is yellow, except the wing insertions, which are black.

Type locality: Austin, Tex.

This variety is based on a single deälated queen which was found accompanied by seven workers and a few larvæ in a small *Holcaspis cinerosus* gall on a live-oak tree. These evidently constituted an incipient colony, remarkable because the queen and two workers were pure yellow, while the five remaining workers were dark-brown with black gasters, like the workers of the typical *fortinodis*. All the workers, however, had the peculiar smoothness of the head and were undoubtedly the offspring of the same mother. I believe this colony must present a case of hybridism, a female of the new variety *gilva* having been fertilized by a male of the typical *fortinodis*. It is difficult to explain the peculiar dichromatism of the workers in this little colony in any other way, since the yellow workers were not callows but perfectly mature, and the queen differed so decidedly in color from the majority of her offspring. Unfortunately the colony was killed by dropping the gall into alcohol before the peculiarities of the workers were noticed.

The Austin specimens of *fortinodis*, together with those representing the varieties *melanoticus* and *gilvus*, all have the petiole much smaller than in Mayr's type and suggest transitions to *Schaumi*. Particularly is this the case with var. *gilvus*, which is based on the female. The female of *Schaumi* and the males of both species being unknown, I am unable to delimit the two species accurately.

8. Leptothorax longispinosus Roger.

L. longispinosus Roger, Berl. Ent. Zeitschr., VII, 1863, p. 180, No. 69. ☿.
L. longispinosus Mayr, Verh. Zool. bot. Ges. Wien, XXXVI, 1886, p. 451. ☿.
L. longispinosus Dalla Torre, Catalog. Hymenopt., VII, 1893, p. 125.
L. longispinosus Emery, Zool. Jahrb. Abth. f. Syst., VIII, 1894, p. 321. ☿ ♀.

Worker (Pl. XII, fig. 9).—Length 2.25–2.5 mm.

Head exclusive of the mandibles not much longer than broad, posterior angles considerably rounded. Mandibles 5-toothed. Eyes of moderate size, rather flattened. Clypeus convex, not impressed in the middle, its anterior border rounded. Antennæ 11-jointed, scape reaching the posterior angle of the head, club 3-jointed; first funicular joint as long as joints 2–4 together; joints 1–3 broader than long; joints 4–6 as long as broad; terminal joint as long as the two pre-

ceding joints together. Thorax rather short, anterior angles rounded but distinct, dorsal surface and pleuræ somewhat flattened; meso-ëpinotal suture distinct but without a constriction. Epinotal spines very long and stout, directed backward, rather suddenly tapering at their tips which are curved slightly inward and downward. Petiole from above suboblong, twice as long as broad, sides nearly parallel, posterior border a little broader than the anterior; in profile the anterior slope is distinctly and evenly concave, the posterior convex; the anterior ventral surface has a distinct but rather blunt tooth; summit of node blunt. Postpetiole hardly half again as broad as the petiole, as long as broad, with rounded but distinct anterior angles, convex dorsally. Gaster of the usual shape, with distinct anterior angles.

Mandibles coarsely longitudinally rugose, hardly shining. Clypeus somewhat shining, traversed even in the middle by several clean-cut longitudinal rugæ. Head shining, especially on the posterior and postero-lateral portions; anteriorly with clean-cut longitudinal rugæ, which are coarsely reticulate and further apart on the cheeks, more delicate on the crown and occiput. Thorax opaque, except the mesonotum, which is somewhat shining. Neck coarsely and evenly punctate; remaining surface of thorax covered with coarse, irregularly longitudinal rugæ which extend up on the epinotal spines; interrugal spaces with shallow foveolate punctures, forming a secondary reticulation. Petiole and postpetiole opaque, coarsely rugose and punctate. Gaster very smooth and shining.

Hairs silvery-white, those on the head, thorax and abdomen very regularly arranged, clavate, erect; on the antennæ and legs minute, non-clavate and appressed.

Head and gaster black; thorax and pedicel dark-brown; antennæ and legs yellow; scape and club of the former, coxæ, femora and sometimes also the tibiæ of the latter, infuscated. Mandibles dark-brown, their distal half yellow.

Female.—Length 3.5–4 mm.

Head opaque, densely and rather finely longitudinally rugose. Eyes moderate; ocelli rather small. Thorax opaque; pronotum coarsely longitudinally rugose; mesonotum traversed by numerous very regular, parallel rugæ. Scutellum somewhat shining, covered with much more delicate rugæ than those of the mesonotum and more reticulate and less longitudinal in direction. Pleuræ, epinotum and epinotal spines covered with coarse reticulate rugæ, which have a decidedly longitudinal trend. Epinotal spines shorter, stouter and less curved than those

of the worker. Petiole and postpetiole opaque and more roughly sculptured than those of the worker. Wings milky-white, the veins and stigma very pale. Pilosity and color of body, legs and antennæ like the worker, except that the thorax is darker and often quite black, especially on the dorsal surface.

Male.—Length 2–2.5 mm.

Head, exclusive of the mandibles, about as broad as long. Eyes very prominent; ocelli reniform. Mandibles overlapping, small, acute, dentate. Antennæ 12-jointed; scape as long as joints 1–4 of the funiculus, the funiculus with a 4-jointed club; first funicular joint swollen, somewhat longer than joints 2–3 together; joints 3–7 cylindrical, about twice as long as broad, joints of club fusiform gradually increasing in length distally. Thorax with strongly marked parapsidal and Mayrian furrows. Epinotum evenly rounded, with two small prominences in the place of the large spines of the worker and queen. Petiole larger and postpetiole more slender than in the worker and both with much lower nodes, the former somewhat pedunculate, the latter subquadrate from above, with rounded angles, as long as broad and hardly half again as broad as the petiole. Gaster of the usual shape. Legs rather long and slender.

Clypeus shining, with a few clean-cut, longitudinal rugæ. Head subopaque, indistinctly rugose and punctate except the cheeks, where the rugæ are pronounced and reticulate. Thorax smooth; pleuræ, mesonotum and scutellum shining, their surfaces indistinctly and irregularly punctate at the sutures. Epinotum opaque, very finely rugose. Petiole and postpetiole opaque, finely rugose; the upper surfaces of the nodes, especially of the postpetiole, smooth and almost shining. Gaster subopaque.

Hairs on the body few and very slender, whitish; longest on the gaster; those on the legs and antennæ minute and appressed.

Black; mandibles, antennæ, legs and genitalia white. Bases of mandibles, scape, antennal club, coxæ, femora, tibiæ and last tarsal joint of each foot, distinctly infuscated. Wings milky-white with very pale veins and stigma.

Type locality: "America."

Additional localities: Virginia (Mayr); District of Columbia (Pergande); New York (Schmelter); Colebrook, Litchfield county, Conn.

This species is evidently allied to *L. curvispinosus*, but is readily distinguished by its dark coloration, strong epinotal spines, shining head, etc. The specimens from which the above description was drawn may be considerably darker than Rogers' types. In most of

my material the thorax of the worker is black, and the head rather smooth so as to resemble the forms described by Emery from New York and by Mayr from Virginia.

L. longispinosus appears to be confined to the Eastern United States. At any rate I have not yet been able to find it in the Middle West or among my material from the Western States. At Colebrook, Conn., the workers of this species are often seen running over the leaves or bushes in rather damp, shady places. The nests, containing the winged females and males in August, were found in clefts of granite boulders and in worm-eaten hickory nuts on the ground under the trees in the woods. Some of the colonies were quite populous for *Leptothorax* colonies, others very small.

9. Leptothorax curvispinosus Mayr.

L. curvispinosus Mayr, Sitz. B. k. Akad. Wiss. Wien, LIII, 1866, p. 508. ☿.
Stenamma gallarum Patton, Am. Natural., 1879, p. 126. ☿ ♀.
L. curvispinosus Mayr, Verhand. zool. bot. Ges. Wien, XXXVI, 1886, pp. 451 and 453. ♀.
L. curvispinosus Dalla Torre, Catalog. Hymenopt., VII, 1893, p. 124.
L. curvispinosus Emery, Zool. Jahrb. Abth. f. Syst., VIII, 1894, pp. 317 and 320.

Worker (Pl. XII, fig. 10).—Length 2–2.5 mm.

Mandibles 5-toothed. Clypeus moderately convex, with broadly rounded anterior border, without median impression. Antennæ 11-jointed, scape reaching to midway between the eye and the posterior corner of the head; funiculus terminating in a distinct 3-jointed club; first funicular joint nearly as long as the three succeeding joints together; joints 2–7 about as long as wide; terminal joint little longer than the two preceding joints of the club taken together. Thorax but little broader in front above than below and behind; humeri slightly angular; dorsum convex, without promesonotal and mesoëpinotal sutures and without a constriction at the latter region. Epinotal spines long and slender, tapering rather rapidly at their tips; directed backward and slightly upward, their tips incurved and slightly converging. Petiole from above more than twice as long as broad, distinctly narrower at the anterior peduncular end than behind; node in profile rather blunt, with longer and slightly concave anterior slope and convex posterior slope; lower surface laterally compressed, with a small but distinct downwardly directed tooth near the anterior end. Postpetiole globose, about half again as broad as the petiole, almost circular when seen from above. Gaster short, elliptical, with small but distinct basal angles.

Mandibles shining, with indistinct longitudinal striæ. Clypeus longitudinally rugose, even in the middle. Head opaque, covered

with fine longitudinal rugæ separated by densely foveolate punctures. Thorax opaque, coarsely and irregularly longitudinally rugose, except just back of the neck where there are a few transverse rugæ. The rugæ on different parts of the thorax are so fine that their trend is hardly discernible except under a high magnification. Lower pleuræ foveolate-punctate. Petiole and postpetiole somewhat less roughly sculptured than the head and thorax; both densely foveolate-punctate; punctures on the petiole somewhat coarser than on the postpetiole, which therefore often appears smoother. Gaster and legs smooth and shining.

Hairs whitish, those on the head, thorax and pedicel shorter and more clavate than those on the gaster. Hairs on the legs and antennæ short, non-clavate and appressed.

Yellow; head, thorax and gaster tinged with brown; mandibles, legs, antennæ and venter pale, sometimes whitish; edges of mandibles and a large triangular spot on either side of the first gastric segment, black or dark-brown. In some specimens the femora are slightly infuscated.

Female (deälated).—Length 2.75–3.3 mm.

Longitudinal rugæ of the head more prominent than in the worker. Pronotum coarsely reticulate-rugose. Mesonotum shining, especially in front and in the parapsidal regions, longitudinally rugose, as are also the paraptera and scutellum. Epinotum with coarse, transverse rugæ, especially below the spines, which are shorter and stouter than in the worker. Pleuræ and sterna coarsely longitudinally rugose. Sculpturing of the petiole and postpetiole like that of the worker but more pronounced, so that these segments are quite opaque. Upper surface of head, scutellum, posterior portion of epinotum, wing-insertions, lower pleuræ, posterior portions of petiole and postpetiole, a broad band across the first gastric segment and all except the borders of the posterior gastric segments, dark-brown or black.

Type locality: ?District of Columbia.

Additional localities: Virginia (Mayr); Beatty, Pa. (Schmitt); Belmont, N. C. (Schmitt); Covington, Ky. (Schmitt); New York (Emery); New Jersey (Emery).

This species in its typical form appears to be confined to the Eastern United States. Patton found small colonies of it nesting in the hollow galls on the golden-rod (*Solidago*). Rev. P. J. Schmitt, O.S.B., who has frequently taken the species in Pennsylvania, sends me the following note on its habits: "In one locality at least where *curvispinosus* was abundant the colonies were in saplings of ash, the tops of

which had been eaten off by cattle and hollowed out, perhaps by some larger insect than *Leptothorax*. At all events, when I visited these colonies in autumn (I knew of their existence by watching foraging workers going in and out of the nests) every colony had been dislodged and dispossessed of its premises by a species of wasp which was busily bringing in paralyzed spiders. The *L. curvispinosus* had then retired to hollows in stumps or logs or dead branches lying on the ground." This species is also of interest because it is enslaved by *Tomognathus americanus* Emery, in the nests of which it has been found by Pergande.

9a. Subsp. **ambiguus** Emery (Pl. XII, fig. 11).

L. curvispinosus Mayr subsp. *ambiguus* Emery, Zool. Jahrb. Abth. f. Syst., VIII, 1894, p. 320.

Differs from the typical *curvispinosus* in the somewhat coarser sculpturing and the decidedly shorter and nearly straight epinotal spines.

Type localities: Hill City, S. Dak. (Pergande); Cleveland, O. (Wasmann); New York (Schmelter).

A number of specimens collected at Colebrook, Conn., have the same sculpturing as the typical *curvispinosus* but decidedly shorter epinotal spines. These were found running on the surfaces of leaves in the shade of very damp woods. I failed to discover the nests.

9b. Subsp. **rugatulus** Emery (Pl. XII, fig. 12).

L. rugatulus Emery, Zool. Jahrb. Abth. f. Syst., VIII, 1894, p. 321.

Owing to the existence of the next subspecies (*annectens*), I feel justified in regarding Emery's *L. rugatulus* merely as a subspecies of *curvispinosus*. The type specimens were from South Dakota (Pergande) and Colorado (Pergande). Specimens from Seattle, Wash. (Kincaid), in my collection agree very closely with Emery's description. They differ from the typical *curvispinosus* in the following characters: The rugæ of the head and thorax are decidedly coarser, and longitudinal on the latter. Epinotal spines much shorter and hardly curved. Tooth on the anterior ventral surface of the petiole distinctly larger, blunter and directed downward and forward. Postpetiole broader than long, oblong when seen from above, with rather distinct anterior angles. In profile the upper surface of the postpetiole is almost angular, its ventral surface very short. Upper surface of head and gaster, with the exception of the posterior edges of the segments of the latter, dark-brown. Femora more or less infuscated in some specimens.

9c. Var. **Cockerelli** var. nov.

Worker.—Length 2–2.5 mm.

Differs from the typical *rugatulus* in having the head, thorax and

petiole less opaque, owing to the rugæ being further apart and the smooth interrugal spaces more prominent. Epinotal spines shorter and more acute. Postpetiole somewhat longer, being intermediate in shape between that of the typical *curvispinosus* and *rugatulus*, but distinctly wider in front than behind, and with rounded but perceptible anterior angles. The coloration is also intermediate between the forms just mentioned. Upper surface of head pale-brown and more of the cheeks, sides and front of head yellow than in *rugatulus*, whereas the infuscation of the gaster is limited to the posterior dorsal half or two-thirds of the first segment, leaving the remaining segments yellow.

Female (deälated).—Length 3–3.5 mm.

Whole body, with the exception of the legs and antennæ, yellowish-brown; head and gaster, with the exception of the base of its first segment, darker. Antennæ and legs more yellowish. Pedicel, especially the petiole, very rough, and surmounted by a more acute node than in the worker.

A fine living colony of this species, comprising more than a hundred workers and eight females, was sent me by Prof. T. D. A. Cockerell from Las Vegas Hot Springs, N. M. Fragments of bark accompanying the ants showed that the nest was found in a tree trunk.

9d. Subsp. annectens subsp. nov. (Pl. XII, fig. 13).

Worker.—Length 2–2.5 mm.

This form has the epinotal spines long and thin, and shaped like those of the typical *curvispinosus*. Head very coarsely longitudinally rugose, subopaque. Pronotum evenly and coarsely foveolate-punctate, meso- and epinotum opaque, coarsely reticulate rugose, the rugæ without a longitudinal trend. Petiole and postpetiole opaque, shaped like those of *rugatulus*, the former with a prominent ventral tooth, directed downward and forward. Upper surface of head and whole dorsal surface of gaster, except a large, transversely elliptical spot on the anterior portion of the first segment and the extreme posterior edge of this and the remaining segments, dark-brown or black. Remainder of body brownish-yellow.

Type locality: Boulder, Colo.

Described from four specimens collected by Rev. P. J. Schmitt, O.S.B.

This form is clearly intermediate in structure and coloration between the typical *curvispinosus* and the subspecies *rugatulus*.

10. Leptothorax Schmittii sp. nov.

Worker (Pl. XII, fig. 14).—Length 2–2.25 mm.

Head conspicuously narrow, with parallel sides, decidedly longer

than broad, with straight posterior border. Mandibles 5-toothed. Clypeus moderately convex, its anterior border with a small but distinct excision in the center and a distinct median carina extending nearly its full length. Antennæ 12-jointed; scape reaching the posterior corner of the head; first funicular joint as long as joints 2–4 together; second joint as long as broad; joints 3–8 nearly as long as broad; club distinctly 3-jointed, first and second joints subequal, together a little shorter than the terminal joint. Thorax rather long and narrow, widest in front where the humeral angles are sharp and prominent. In profile the pronotum rises very abruptly from the neck, so that a transverse ridge is formed which gives the thorax a square-shouldered appearance; dorsum flatly and evenly rounded, without mesoëpinotal constriction. Epinotal spines well-developed, longer than broad at their bases, tapering and pointed, directed distinctly backward though slightly upward and outward; in profile the ventral outline of the spines is distinctly concave, the dorsal convex. They are about as long as their distance apart at the base. Petiole about 1½ times as long as broad, distinctly broader behind than in front when seen from above; in profile the height of the node is fully equal to the length of the whole joint; its anterior surface is steep and somewhat concave, the top of the node abruptly truncated, the posterior slope so steep that it is even inclined forward below and forms somewhat less than a right angle with the extreme posterior dorsal surface of the petiole; ventral tooth well developed, directed downward. Postpetiole hardly twice as broad as the petiole, distinctly broader than long; its anterior wider than its posterior border, its anterior angles rather prominent. Gaster of the usual shape.

Mandibles not distinctly striated; shining, with a few coarse punctures. Clypeus shining, longitudinally rugose on the sides. Head very smooth and shining, covered with rather coarse but sparse piligerous punctures; sides of frontal area, cheeks and subocular region subopaque and delicately longitudinally rugose. Pro- and mesonotum very smooth and shining, with a few piligerous punctures passing over onto the pleuræ into delicate longitudinal rugæ, which become much coarser and distinctly reticulate on the sides and whole upper surface of the epinotum. Petiole and postpetiole opaque, reticulate and punctate-rugose. Gaster very smooth, shining.

Hairs white, only moderately abundant; clavate and erect on the thorax and crown of head, somewhat longer and more reclinate on the pedicel and gaster; the hairs on the sides of the head, antennæ and legs non-clavate, appressed; those on the clypeus thin and projecting.

Very dark-brown, almost black. Mandibles, neck, funiculus and legs yellow; scape and club of antennæ and the middle of the femora and tibiæ infuscated; edges of mandibles black.

Type locality: Cañon City, Colo.

Described from four specimens collected by Rev. P. J. Schmitt, O.S.B., to whom I take pleasure in dedicating this very striking species. It is quite unlike any of the other described North American forms in the shape of the thorax and petiole and the smoothness of the head, pro- and mesonotum.

11. Leptothorax nitens Emery.

L. nitens Emery, Zool. Jahrb. Abth. f. Syst., VIII, 1894, pp. 318, 322, 323.

Worker (Pl. XII, fig. 15).—Length 2–2.25 mm.

Mandibles 5-toothed; basal teeth very small. Clypeus moderately convex, impressed in the middle and with sinuately excised anterior border. Antennæ 12-jointed; scape reaching to $\frac{2}{3}$ the distance between the eye and the posterior angle of the head; funiculus terminating in a distinctly 3-jointed club, the two basal joints of which are subequal in length, together decidedly shorter than the terminal joint; first funicular joint as long as the three succeeding joints together, joints 2–7 of the funiculus slightly broader than long, the 8th about as long as broad. Thorax slender, somewhat broader in front than behind; compressed laterally, pronotum rather prominent and square in front, humeri rounded; in profile the dorsal surface is somewhat flattened and without mesoëpinotal constriction. Epinotal spines very small, tooth-like, hardly as long as broad at their bases, directed upward, about as far apart as they are broad at their bases. Petiole about $1\frac{1}{2}$ times as long as broad, gradually widened behind when seen from above; in profile the node is very high, its anterior slope steep and concave, its summit very short and rounded, the posterior slope abrupt, the ventral tooth is distinct and pointed forward and downward. Petiole nodiform, a little broader than long, half again as broad as the petiole, its anterior angles much rounded. Gaster of the usual shape.

Mandibles smooth and shining, indistinctly striated and punctate. Clypeus smooth and shining, with a few longitudinal rugæ on its antero-lateral surfaces. Head very smooth and shining, minutely and sparsely punctate; sides of front, antennal foveæ and cheeks longitudinal rugulose. Thorax, petiole and postpetiole opaque, finely and regularly foveolate-reticulate. In some specimens more or less of the pro- and mesonotum is shining. Pleuræ faintly striated longitudinally. Gaster very smooth and shining.

Hairs moderately abundant, yellow; clavate on crown of head, thorax

and abdomen; erect and shorter on head and thorax; longer and slightly reclinate on the pedicel and gaster; hairs on sides of head, legs and antennæ minute, non-clavate, appressed.

Yellow, in some specimens crown of head, antennal club and dorsum of gaster slightly infuscated.

Type locality: American Fork Cañon, Utah (Pergande).

Additional localities: Pacific Grove, Cal. (Dr. H. Heath); Cañon City, Colo. (Rev. P. J. Schmitt, O.S.B.).

Emery described the species from a single specimen in which the thorax was shining. Examination of a number of California and Colorado specimens from the same nests shows this to be a common but by no means constant character; in a great many individuals the thorax is uniformly opaque throughout.

One of the colonies sent me by Dr. Heath was found in the ground, hibernating in a Termite burrow.

11a. Var. **Heathii** var. nov.

Worker.—Differs from the preceding in the coloration, which is constant in a whole colony sent me by Dr. Harold Heath from Pacific Grove, Cal. The body is brown, often rather dark, the legs and antennæ brownish-white without the distinct yellow cast of the typical form.

Found nesting in the ground under a stone.

11b. Subsp. **occidentalis** subsp. nov.

Worker.—This form combines the color characters of the type and the preceding variety. The ground color is yellow, the upper surface of the head, thorax and pedicel brown; the first gastric segment with a broad, brown dorsal band across its posterior half or two-thirds. Thorax and pedicel decidedly opaque. Antennal scape nearly reaching the posterior angle of the head, epinotal spines decidedly more robust than in the typical *nitens* and the var. *Heathii*.

Type locality: Friday Harbor, Wash.

Described from six specimens received from Prof. Trevor Kincaid.

12. Leptothorax texanus sp. nov.

Worker (Pl. XII, fig. 16).—Length 2.25–2.75 mm.

Head longer than broad. Eyes rather large. Mandibles 5-toothed. Clypeus moderately convex, its anterior border somewhat rounded. Antennæ 12-jointed; scape reaching nearly to the posterior angle of the head; funiculus terminating in a very distinct 3-jointed club, the last joint of which is somewhat longer than the two preceding joints; first funicular joint nearly as long as joints 2–5;

second funicular joint about as long as broad, the remaining joints broader than long. Thorax rather short, its humeral angles rounded, dorsum evenly and slightly rounded, without mesoëpinotal constriction. Epinotal spines moderate, distinctly shorter than the declivous surface of the epinotum, scarcely as long as their distance apart at the base, rapidly tapering, acute, directed upward, outward and backward. their tips slightly deflected. Petiole from above fully 1½ times as long as broad; its sides somewhat convex, so that its outline is subelliptical; in profile the anterior slope is abrupt and distinctly concave, the summit of the node flattened, and the posterior slope suddenly declivous; ventral tooth small, acute, directed downward. Postpetiole very large, fully twice as broad as the petiole; broader than long, its anterior and posterior angles rounded, so that it appears transversely elliptical from above; in profile it is very convex, especially in front. Gaster elliptical, depressed, without distinct anterior angles.

Mandibles coarsely striated. Clypeus traversed by several clean-cut longitudinal rugæ, subsiding on the posterior portion which is smooth and shining. Head subopaque, coarsely reticulate-rugose; the rugæ distinctly longitudinal only on the front and vertex; interrugal spaces secondarily reticulate. Neck evenly reticulate; thoracic dorsum very coarsely and irregularly reticulate-rugose; the spaces between the rugæ smooth and shining, because the secondary reticulation is indistinct or lacking. Pleuræ somewhat more delicately and evenly rugose. Petiole and postpetiole coarsely reticulate-rugose, interrugal spaces filled with shallow foveolæ or secondary reticulation. Gaster smooth and shining.

Hairs white, rather numerous and prominent; on the trunk clavate; shorter and more erect on the head and thorax, longer and slightly reclinate on the pedicel and gaster; on the legs and antennæ distinct, non-clavate, more or less appressed.

Black or very dark-brown, especially on the head, thorax and petiole. Mandibles, excepting the teeth, funiculus, tips of epinotal spines, tarsi and articulations of legs, excepting the last tarsal joint, yellow; antennal scape brown.

Female.—Length 3.75–4 mm.

Head more decidedly and extensively longitudinally rugose than in the worker. Neck delicately, pronotum more coarsely reticulate-rugose; mesonotum and paraptera traversed by numerous longitudinal rugæ which are more or less interrupted and have a tendency to anastomose. Scutellum with such rugæ only in front and on the sides,

posteriorly it is nearly smooth and shining. Pleuræ and epinotum with rather coarse, distinctly longitudinal rugæ. Epinotal spines small, acute, straight. Petiole with pointed node and more abruptly declivous posterior slope than in the worker, its dorsal surface scarcely flattened. Postpetiole very convex in front above. Sculpturing of petiole and postpetiole as in the worker. Color of head, thorax and pedicel reddish-brown, darker on the dorsal surface. Gaster black. Pilosity of body and legs and color of the latter much as in the worker. Wings whitish-hyaline; veins and stigma yellow.

Male.—Length 2–2.5 mm.

Head exclusive of the mandibles broader than long, cheeks short, posterior angles convex and rounded. Mandibles overlapping each other. Antennæ 13-jointed; scape as long as the first four joints of the funiculus, club very distinct, 4-jointed, the first, second and third subequal, fully 1½ times as long as broad, apical joint as long as the second and third together; first funicular joint somewhat swollen, fully 1½ times as long as broad; joints 2–8 longer than broad. Epinotum with two very small, indistinct protuberances in the place of the spines. Petiole slender, in profile concave below; anterior dorsal slope nearly straight, gradual, posterior slope shorter, abruptly declivous, rather concave. Postpetiole campanulate, about as long as broad; 1½ times as broad as the petiole. Legs long and slender.

Mandibles striated. Clypeus coarsely and irregularly reticulate-rugose, shining. Head subopaque, evenly and rather delicately reticulate-rugose. Neck finely reticulate; mesonotum shining, with a faint reproduction of the irregular rugosity of the worker; remainder of thorax and the pedicel delicately reticulate-punctate. Gaster smooth and shining.

Hairs white, non-clavate, long and moderately abundant on the mandibles, pedicel and gaster; sparser elsewhere.

Black; mandibles and genitalia yellow; antennal funiculus grayish-brown; wings like those of female; legs like those of the worker in color.

Type locality: Milano, Millan County, Tex.

All three sexual phases of this species were taken May 23, 1902, in nests consisting of a few small galleries, 3–4 inches long, excavated in the sand in rather damp spots under post-oaks and cedars.

13. Leptothorax tricarinatus Emery.

L. tricarinatus Emery, Zool. Jahrb. Abth. f. Syst., VIII, 1894, pp. 318, 321, 322. ☿.

Worker (Pl. XII, fig. 17).—Length 2.25 mm.

Clypeus produced in front in the middle, obtusely angulate, above

with three slender longitudinal carinæ. Antennæ 12-jointed, first funicular joint longer than the three succeeding joints together; remaining joints shorter than broad; two basal joints of club subequal. Thorax not impressed at the mesoëpinotal suture. Epinotal spines short, rather acute, obliquely erect. Petiole thickened behind, node subconical, obtuse. Postpetiole much larger than the petiole, subglobose.

Mandibles striated. Clypeus shining. Head, thorax and petiole subopaque, punctate and finely rugose, pronotum more shining in the middle.

Hairs on the body clavate, on the legs and antennal scape nonclavate and sparse.

Fuscous black; mandibles, articulations of legs and the tarsi reddish.

Type locality: Hill City, S. Dak. (Pergande).

Described from a single specimen in the collection of Prof. C. Emery.

14. Leptothorax neomexicanus sp. nov.

Worker (Pl. XII, fig. 18).—Length 2.25–2.5 mm.

Head longer than broad. Mandibles 5-toothed. Clypeus moderately convex, broadly rounded in front, not impressed. Antennæ slender, 12-jointed; scape extending to a distance equal to its own breadth beyond the posterior angle of the head; funiculus terminating in a 3-jointed club, the two basal joints of which are subequal and together shorter than the terminal joint; first funicular joint as long as the three succeeding joints together; joints 2–8 of the funiculus as long as broad. Thorax not much broader in front and above than behind and below; humeral angles rounded; dorsal surface flattened, without mesoëpinotal suture or constriction. Epinotal spines short, robust, blunt, not longer than broad at their bases and nearly twice as far apart at their bases as long. They are directed obliquely upward, outward and backward. Petiole hardly 1½ times as long as broad; distinctly wider behind than in front, sides somewhat convex; in profile the node is nearly as high as the length of the petiole, its anterior slope steep, slightly concave; the summit somewhat truncated, passing abruptly into the angular posterior declivity; ventral surface in front with a prominent tooth, directed downward and forward. Postpetiole nearly twice as broad as the petiole; nearly as long as broad, subglobular, its anterior dorsal surface in profile abruptly convex, the posterior dorsal surface more flattened. Gaster of the usual shape with slight basal angles.

Mandibles coarsely striated and punctate. Clypeus longitudinally rugose, especially on the sides, behind without rugæ, smooth and

shining, somewhat foveolate-punctate. Head subopaque except along a broad median strip, extending from the frontal area to the occiput, and on the posterior angles. These regions are smooth and shining. Cheeks and sides of head rather delicately and longitudinally reticulate-rugose. On the front and vertex there are also a few rather large indentations at widely separated intervals. Thorax nearly opaque, in front delicately and evenly reticulate-rugose; on the epinotum and pleuræ the rugæ are coarser and have a distinctly longitudinal trend. Petiole and postpetiole nearly opaque, finely reticulate-rugose. Gaster very smooth and shining.

Hairs rather sparse, silvery-white; those on the body subclavate, shorter and more erect on the head and thorax, longer and more reclinate on the pedicel and gaster. Hairs on the legs and antennæ short, non-clavate, appressed.

Black. In some specimens the pedicel and thorax are dark-brown. Scape and funiculus of antennæ brown. Mandibles yellow, with black teeth. Legs yellow, middle portion of the femora and tibiæ and terminal tarsal joint on each foot, black.

Type locality: Manzanares, N. M.

Described from five specimens taken by Miss Mary Cooper. The species is obviously closely related to *L. tricarinatus* Emery, and may prove to be merely a subspecies of this form. To judge from Emery's description, the head of *tricarinatus* is more opaque, the mesonotum shining, the first funicular joint larger than the three succeeding joints, the remaining joints of the funiculus shorter than broad. Apparently, also, the postpetiole is considerably larger than in *neomexicanus*.

15. Leptothorax obturator sp. nov.

Worker (Pl. XII, fig. 19).—Length 2.25–2.75 mm.

Mandibles 5-toothed. Clypeus rather flat, its anterior margin broadly truncated in the middle. Antennæ 12-jointed; scape reaching posterior angle of head; first funicular joint as long as the three succeeding joints; joints 3–8 broader than long, joints 9–11 forming a club, the ninth distinctly narrower and shorter than the tenth, the terminal joint longer and considerably thicker than the two preceding joints. Thorax slender, somewhat broader in front than behind; rounded at the humeri, in profile convex in front and slightly concave behind on the dorsal surface, without mesoëpinotal constriction. Epinotal spines small, rather acute, not longer than broad at their bases, nor further apart than long, directed upward. In front and

on the side of each epinotal spine there is a distinct longitudinal swelling or ridge on the epinotum. Petiole very slender, three times as long as broad, sides of the node parallel, the peduncle somewhat narrower when seen from above; in profile the lower surface is evenly concave, the anterior tooth minute; the dorsal surface with a low regularly rounded, knoll-like node. Postpetiole small, about 1½ times as broad as the petiole, as broad as long, square when seen from above, with prominent anterior angles; in profile the lower surface is flattened, the upper convex, especially in front. Gaster with distinct anterior angles. Sting well developed.

Mandibles opaque, striated and with a few coarse punctures. Clypeus subopaque, its whole surface longitudinally rugose. Head subopaque in front and on the sides, shining behind, on the former regions densely and rather finely reticulate-rugose; the rugæ with a distinct longitudinal trend except on an opaque patch above each eye, where the rugæ are evenly reticulate. The shining portion of the head is traversed by clean-cut longitudinal rugæ much farther apart than on the front and crown and interspersed with a few coarse punctures; posterior angles of head delicately reticulate. Thorax subopaque; pronotal region more shining, foveolate-reticulate on the whole dorsal surface; pleuræ more coarsely reticulate-rugose, with pronounced longitudinal trend in a few of the rugæ, especially in the upper meso- and lower metapleuræ. Petiole and postpetiole subopaque, rather evenly foveolate-reticulate. Gaster smooth and shining.

Hairs moderately abundant, snow-white; clavate on the crown of the head, thorax, pedicel and gaster; a little longer on the pedicel and gaster and somewhat more reclinate. Hairs on the legs and antennæ sparse, non-clavate, appressed and inconspicuous.

Black or very dark-brown. Mandibles, joints 3–9 of the antennæ, neck, ventral surface of petiole and postpetiole reddish-yellow. Legs reddish-yellow, except the middle of the coxæ, femora, tibiæ and last tarsal joint, which are black.

Female.—Length 3.5–3.75 mm.

Clypeus and head more coarsely longitudinally rugose and more opaque than in the worker. Thorax subopaque; neck delicately reticulate-rugose; pronotum transversely and irregularly rugose; mesonotum, paraptera and scutellum traversed by dense, parallel, clean-cut, longitudinal rugæ. Epinotum delicately and somewhat concentrically reticulate-rugose; armed with two inconspicuous swellings in the place of the spines; pleuræ longitudinally rugose. Petiole and postpetiole like those of the worker, the node of the former relatively lower; post-

petiole hardly 1½ times as broad as the petiole. The white hairs on the body are non-clavate, though those on the pedicel and gaster are somewhat thickened. Head, thorax and pedicel yellowish-red or dark-red, their upper surfaces more or less infuscated. Gaster black. Antennal scape black with basal half yellow; first joint of funiculus and club black, remaining joints yellow. Legs colored like those of the worker. Wings milky-white, veins yellow; stigma brown, conspicuous.

Male.—Length 1.5–2 mm.

Head as long as broad, exclusive of the mandibles; cheeks very short. Mandibles meeting with their tips. Clypeus convex, truncated in front. Antennæ slender; 13-jointed; scape nearly as long as the first five joints of the flagellum; first flagellar joint thickened, nearly as long as the three following joints together; joints 2–8 of the flagellum cylindrical, as long as broad; the four terminal joints forming a club, of which the three basal joints are subequal in length but increase somewhat in thickness distally; terminal joint much larger, distinctly longer than the two preceding joints. Epinotum with two very inconspicuous thickenings in the place of the spines. Petiole and postpetiole similar in shape to the corresponding segments of the worker, node of former very low.

Clypeus shining, with a few reticulate rugæ forming rather large meshes. Head, thorax and pedicel opaque, finely and evenly reticulate-rugose. Mesonotum sparsely foveolate-punctate and traversed by a narrow, smooth, longitudinal stripe. Pleuræ shining in part. Gaster smooth and shining.

Hairs white, sparse, non-clavate, most abundant on the thoracic dorsum, pedicel and gaster.

Black; pleuræ and pedicel more piceous. Mandibles, legs and antennæ white; the mandibles with brown edges, the antennæ with scape, second joint and club blackened; legs with the coxæ, middle of the femora and tibiæ and the last tarsal joint blackened.

Type locality: Austin, Tex.

Described from many specimens collected at different times from the abandoned *Holcaspis cinerosus* galls on the live-oaks (*Q. virginiana*). The young fertilized queen, on entering the gall to establish her colony, gnaws minute fragments from the ligneous wall, mixes these with some secretion (saliva?) and completely plugs up the round opening through which the *Holcaspis* escaped and she herself has entered. Later when the first batch of tiny workers appear, they perforate the center of the plug with a small opening like a pin-prick, and just large enough for egress and ingress. This opening is too small for

the queen to pass, so that she remains imprisoned. With the growth of the colony the chamber formerly made and inhabited by the *Holcaspis* larva is enlarged by the workers. The queen with the larvæ prefers to inhabit the small central capsule in which the *Holcaspis* passed its pupal life. The larvæ are of a peculiar greenish tint. The males and virgin females make their appearance in the colony during the last week of May. At no time are the colonies of *L. obturator* very large. They rarely comprise more than 36 or 40 workers. Members of different colonies, even from galls on the same branch, are extremely hostile to one another. Along the creek-bottoms near Austin, *L. obturator* is also occasionally found nesting in the twigs of the wafer-ash (*Ptelea trifoliata*) which have been hollowed out by tiny carpenter-bees (*Ceratina nanula* Ckll. and *C. arizonensis* Ckll.). The relatively large entrance made by the bees at the end of the twig is plugged up by the ants with agglutinated vegetable particles and then perforated with a minute opening in the center.

16. Leptothorax nevadensis sp. nov.

Worker (Pl. XII, fig. 20).—Length 2.5–3 mm.

Mandibles 5-toothed. Clypeus depressed in the middle, its anterior margin sinuately excised. Antennæ 12-jointed, scape reaching to posterior corner of the head, first funicular joint as long as joints 2–4 together, joints 2–6 slightly broader than long, joints 7 and 8 as long as broad; two basal joints of club subequal, together shorter than the terminal joint. Thorax above in front of about the same width as below and behind; humeri much rounded, dorsum flattened in profile, without mesoëpinotal constriction. Epinotal spines robust, pointed, decidedly longer than broad at their bases, and nearer together at their bases than long, directed upward, outward and backward. Petiole 1½ times as long as broad, sides of node rounded, broader than the peduncle; seen from above the node is transverse, in profile it is narrow antero-posteriorly, its anterior slope gently ascending, concave, its posterior slope more abrupt, also concave, summit rounded; ventral surface of petiole with a prominent, compressed, downwardly directed tooth. Postpetiole in profile with a prominent, sometimes slightly angular node; the segment seen from above is transversely elliptical, about half again as broad as long, its anterior angles rounded. Gaster and legs of the usual conformation.

Mandibles striate and punctate. Clypeus subopaque, its surface, especially at the sides, traversed by rather coarse longitudinal rugæ. Head with a satiny luster, sparsely punctate and with delicate longitudinal rugæ, which become decidedly reticulate in the antennal

foveæ. Thorax subopaque, its dorsal surface irregularly reticulate-rugose and foveolate, pleuræ, petiole and postpetiole regularly foveolate-punctate; posterior epinotal declivity rather coarsely longitudinally rugose. Gaster smooth and shining.

Hairs yellow, not very abundant; clavate on thorax, pedicel and crown of head; short and erect on head and thorax, longer and somewhat reclinate on the pedicel and gaster. Hairs on antennæ, legs and sides of head less conspicuous and appressed, except on the antennæ, where they are suberect.

Rather dark reddish-brown, ventral portions of head, thorax and pedicel and the incisures of the gastric segments, yellowish. Legs and antennæ yellowish, middle of femora and the antennal club dark-brown. Immature specimens have the thorax and pedicel more extensively yellow.

Female (deälated).—Length 4.5 mm.

Mandibles densely striated and somewhat punctate. Clypeus with coarse longitudinal rugæ, one of which forms a distinct carina in the middle of the sclerite. Frontal area opaque. Head with coarse and very regular longitudinal rugæ, but little diverging behind and but slightly reticulate. On the upper surface of the head there are also a number of shallow but distinct foveolæ in the interrugal furrows. Pronotum and pleuræ coarsely longitudinally rugose; mesonotum shining, sparsely foveolate and rather indistinctly longitudinally rugose, especially in front. Scutellum and paraptera like the mesonotum, the former with indications of rugæ only at its anterior border. Whole epinotum subopaque, coarsely rugose, even over the entire surface of the robust, pointed spines, which are as long as they are broad at their bases. Declivous surface of epinotum regularly transversely rugose. Petiole and postpetiole opaque, reticulate and punctate-rugose, more coarsely on the sides than on the summits of the nodes; petiolar node in profile more acute than in the worker. Gaster very glabrous. Head, thorax and pedicel rich reddish-brown; gaster decidedly darker. Legs and antennæ yellow. In the latter all the joints of the funiculus are distinctly longer than broad, and the club, which is not infuscated, is indistinct. Wing-insertions black, Hairs on the body sparse, yellow, not clavate like those of the worker, but more or less tapering.

Male.—Length 2.5–3 mm.

Mandibles dentate, overlapping with their blades. Clypeus convex, truncated in the middle in front. Antennæ 13-jointed; scape slender, as long as joints 1–5 of the funiculus. First funicular joint fully twice

as long as broad, much stouter than the succeeding joints, except those of the 4-jointed club; joints 3–7 longer than broad; three basal joints of club subequal, each not more than half as long as the terminal joint. Cheeks short. Thorax with very deep Mayrian and other sutures. Epinotum without indications of spines. Petiole and postpetiole longer and with lower nodes than in the worker. Gaster of the usual shape.

Mandibles and clypeus somewhat shining, the latter with a few prominent and irregular longitudinal rugæ. Head decidedly opaque, uniformly and densely punctate. Thorax shining, mesonotum, scutellum and pleuræ with faint, parallel, longitudinal striæ. Pronotum and epinotum more reticulate-rugose. Petiole and postpetiole smooth and shining on the summits of the nodes, elsewhere subopaque, finely reticulate-rugose. Gaster smooth and shining.

Hairs covering the body sparse, whitish, non-clavate, longest and most conspicuous on the gaster, very small and appressed on the legs and antennæ.

Black, thorax and pedicel more piceous, especially on their lateral and ventral surfaces. The following parts are yellowish, or yellow suffused with piceous: mandibles, except their teeth, which are black, antennæ, legs and genitalia. Wings whitish-hyaline, veins and stigma colorless.

Type locality: King's Cañon, Ormsby county, Nev.

Described from eight workers, one female and eight males, found by Mr. C. F. Baker during August, 1902, nesting in the ground under a stone.

This species appears to be similar to *L. tricarinatus* Emery, but differs in the shape of the clypeus, which is impressed and sinuately excised and not produced, and in the shape of the epinotal spines, petiole, etc.

17. Leptothorax terrigena sp. nov.

Worker (Pl. XII, fig. 21).—Length 1.5–1.75 mm.

Head rather narrow, with parallel sides. Mandibles 5-toothed. Clypeus moderately convex, without median impression and with broadly rounded, non-sinuate anterior border. Antennæ 12-jointed, scape extending to $\frac{2}{3}$ the distance between the eye and the posterior corner of the head; first funicular joint as long as the three succeeding joints together; joints 2–8 of funiculus decidedly broader than long, subequal; three terminal joints forming a distinct club, of which the two basal joints are subequal in length but not in thickness, and together shorter than the terminal joint. Thorax slender, somewhat broader in front than behind, with rounded humeral angles and moderately

elevated anterior pronotal border. Pleuræ compressed; dorsum flattened and without mesoëpinotal constrictions. Epinotal spines small, conical, distinctly longer and further apart than broad at their bases. Petiole short, hardly 1½ times as long as broad, sides of node convex when seen from above and much broader than the peduncle; in profile the node is high and very thick with an evenly rounded summit, very steep and concave anterior, and very abrupt posterior declivity; ventral tooth rather large, blunt. Postpetiole twice as broad as the petiole, distinctly broader than long, transversely elliptical from above, with rounded anterior angles. Gaster of the usual shape.

Mandibles and clypeus subopaque, the former longitudinally striated and with a few coarse punctures, the latter longitudinally rugose. Head opaque throughout, evenly and densely punctate except along the sides of the frontal region, where there are a few delicate longitudinal rugæ. Thorax, petiole and postpetiole opaque, densely punctate. Gaster smooth and shining.

Hairs white, moderately numerous, clavate on crown of head, thorax and abdomen; erect on head and thorax, more reclinate on the pedicel and gaster; minute, inconspicuous and appressed on the antennæ and legs.

Whole body, even the anterior portion of the gaster, golden-yellow, except the antennal club which is blackened.

Female (deälated).—Length 2.5 mm.

Head opaque, densely punctate; cheeks and whole preocellar region irregularly longitudinally rugulose, the postocellar region and posterior angles more reticulate. Thorax opaque, densely punctate; mesonotum and scutellum with very faint, parallel, longitudinal rugæ. Epinotal spines very short and stout, regularly conical, not as far apart as they are broad at the base. Petiole and postpetiole like those of the worker, but the latter segment fully twice as broad as long. Both segments of the pedicel densely punctate, opaque, except the dorsal surfaces of the nodes which are somewhat smooth and shining. Body brownish-yellow, legs pale-yellow. Antennal club, wing-insertions, sides and posterior border of first gastric segment, a broad transverse band on the second gastric segment and the tip of the gaster, dark-brown. Pilosity like that of the worker.

Type locality: Austin and McNeil (Travis county), Tex.

This small species lives in and on the ground. At Austin I have occasionally seen a few workers running about on the dry gravelly hill-slopes exposed to the sun. At McNeil I took a few dozen workers and a deälated queen, which were inhabiting a small spherical chamber

in the "black waxy" soil under the center of a large flat stone. Two other nests taken at Austin exhibited a tendency toward plesiobiosis. One of these was found in the vegetable débris at the very entrance of the nest of a timid fungus-growing ant (*Trachymyrmex turrifex* Wheeler), the other under a stone at the very edge of a flourishing colony of *Pheidole instabilis* Emery.

L. terrigena is undoubtedly closely allied to *L. Andrei* Emery, which I have not seen. The worker differs, however, in its decidedly smaller size, shape of petiole and postpetiole, its larger and stouter epinotal spines, the absence of a clypeal sinuosity, a shining longitudinal band on the front and vertex, and the absence of infuscation on the abdomen, although the last character is clearly present in the female.

18. Leptothorax Andrei Emery.

L. Andrei Emery, Morph. Jahrb. Abth. f. Syst., VIII, 1894, pp. 318, 322.

Worker (Pl. XII, fig. 22).—Length 2.25 mm.

Clypeus feebly carinate in the middle, its anterior border subsinuate. Antennæ 12-jointed; first funicular joint a little shorter than the three succeeding joints; second joint of club a little longer than the preceding joint. Thoracic dorsum without a mesoëpinotal constriction. Epinotal spines in the form of short, stout teeth. Petiole with a rather long peduncle, its node above subrotund. Postpetiole about a third broader than the petiole, a little broader than long.

Mandibles striated. Head opaque, longitudinally rugulose-punctate; cheeks and clypeus striated, the latter and a median line along the front and vertex shining. Thorax and pedicel opaque; the former densely, the latter more faintly punctate. Gaster and legs shining.

Hairs on the body sparse, short and clavate.

Testaceous, abdomen darker behind, legs pale.

Type locality: California (André).

The species was described from a single specimen in the collection of Prof. Emery.

19. Leptothorax (Dichothorax) Pergandei Emery.

L. (*D.*) *Pergandei* Emery, Zool. Jahrb. Abth. f. Syst., VIII, 1894, pp. 318–323, 324. ☿.

Worker (Pl. XII, figs. 23 and 23*a*).—Length 2.5–3.25 mm.

Mandibles rather broad, 5-toothed. Clypeus moderately convex, broadly rounded in front, with a distinct median carina. Antennæ 12-jointed, scape extending beyond the posterior angle of the head a distance fully equal to twice its breadth; first funicular joint as long as the three succeeding joints together; joints 3–8 nearly as long as broad; club 3-jointed, the two basal joints subequal, together shorter

than the terminal joint. Thorax long, rather robust, not much wider in front than behind, without abrupt declivity at the juncture of the neck and pronotum, pro- and mesonotum convex; mesoëpinotal constriction very deep and broad. Epinotal spines small, not longer than broad at the base, directed upward. Petiole from above nearly three times as long as its greatest width which is in the middle; in profile the node is low and rounded above, the anterior slope very long, at first nearly horizontal, then gradually ascending, the posterior slope shorter, somewhat flattened; summit of node distinctly impressed or concave when seen from behind; ventral surface of peduncle with a long but not very prominent tooth. Postpetiole fully half again as broad as the petiole, a little broader than long, nearly square, its anterior angles prominent, its dorsal surface in profile very convex, especially in front. Gaster rather large, of the usual shape. Sting well developed. Legs robust.

Mandibles longitudinally striated. Clypeus smooth, especially behind, its sides longitudinally rugose. Head smooth and shining above and behind, sparsely punctate and irregularly and delicately reticulate. Antennal foveæ with curved, parallel rugæ; front and cheeks with straight rugæ. Neck opaque and delicately rugose; pro- and mesonotum shining, very finely and irregularly reticulate, pleuræ, epinotum and mesoëpinotal constriction subopaque, coarsely reticulate-rugose; in the constriction and on the meso- and metapleuræ the rugæ have a distinctly longitudinal trend. Declivous surface of epinotum smooth and shining. Petiole and postpetiole shining and finely reticulate above, more opaque and reticulate-rugose on the sides. Gaster smooth and shining, finely and irregularly reticulate.

Hairs white, long and very abundant, obtuse but not clavate, erect on the trunk, suberect on the legs and antennæ.

Black or rich dark-brown, mandibles, antennæ, except the club, frontal carinæ, thorax, pedicel and legs yellowish-red or testaceous. In some specimens the dorsal surface of the thorax and nodes is blackened, while in others the whole of the thorax, nodes and legs is black except the peduncle of the petiole and the tarsi and joints of the legs, which are yellow.

Female.—Length 3.5–4 mm.

Apart from the usual sexual characters, differs from the worker in having the lower surfaces of the head, thorax, pedicel and the legs more yellowish. The smooth surfaces of the body are hardly reticulate. Mesonotum adorned with a median brown blotch on its anterior half and a large comma-shaped spot on either parapsis. Scutellum, epi-

notum and pleuræ more or less spotted with brown, and a small black spot at the insertion of the forewing. Femora and tibiæ infuscated in the middle. Antennal club infuscated. Wings milky-hyaline, with colorless veins and stigma. Concavity at summit of petiolar node very distinct; postpetiole nearly twice as broad as long. Epinotal spines distinctly shorter than broad at their bases.

Male.—Length 2–2.25 mm.

Head a little longer than broad; cheeks very short, eyes and ocelli prominent. Mandibles overlapping, 4-toothed. Clypeus convex. Antennæ 13-jointed, scape about as long as the five succeeding joints, first funicular joint about as long as the second and third together; joints 3–8 slender, cylindrical, subequal, twice as long as broad; club 4-jointed, the three basal joints subequal, together as long as the terminal joint. Thorax long, mesonotum rounded, projecting forward, so that the head is scarcely visible when the insect is viewed from above. Epinotum with a pair of slight projections in the place of the spines. Petiole long and slender, like that of the worker but with lower node. Postpetiole as long as broad, square from above, in profile with the node highest in the middle of the segment and rounded. Gaster and legs of the usual conformation.

Mandibles and clypeus subopaque, the latter coarsely rugose. Head shining, very irregularly and sparsely reticulate, in front of the ocelli with a few shallow foveolæ. Pronotum subopaque, reticulate; mesonotum very smooth and shining, finely reticulate. Scutellum and epinotum more opaque, disk of former coarsely reticulate, sides of both longitudinally rugulose. Petiole and postpetiole opaque, more shining above, delicately corrugated. Gaster very smooth and shining.

Hairs white, rather sparse and long, even on the legs and antennal scape, where they are reclinate but not appressed.

Black. Mandibles, antennæ and legs white except the following portions, which are infuscated or blackened: Edges and teeth of mandibles, terminal joint of antennæ, basal two-thirds of coxæ, middle of femora and tibiæ and last tarsal joint. Wings like those of the female.

Type locality: Washington, D. C. (Pergande).

Additional localities: Morgantown, N. C. (Forel); Austin, Tex.; San Angelo, Tom Green County, Tex.; Toronto, Brewster County, Tex.

The type specimens of this fine species were taken by Mr. Pergande in a nest of *Monomorium minutum* Mayr var. *minimum*, and it was supposed that the *Leptothorax* was a guest in the nests of the *Monomorium*, but Forel, who observed the species in North Carolina, showed that this was altogether an exceptional case. He found *L. Pergandei*

living "in independent formicaries, in the moss of woods or in the earth of meadows, like the ordinary species of *Leptothorax*" (*Ann. Soc. Ent. de Belg.*, Tome XLV, 1901, pp. 389–398). In Texas I have had ample opportunity to observe the habits of this ant, especially in the neighborhood of Austin, where it is found making its nests in very sparsely grassy spots among the mesquite and Opuntia thickets. The nests can be found only by carefully tracking foraging workers, as the entrance is a small hole often concealed under a dead twig or a tuft of grass roots. The colonies are hardly more populous than those of other species of *Leptothorax*. The winged forms appear during the last week in April and the first week in May. The workers run about on the soil in the hot sun as fierce hunters of small insects (Aphids, minute Heteroptera, etc). As they are extremely pugnacious even toward individuals of the same species from other nests, and as I have never found them nesting with *Monomorium minimum*, though this species is very common in the same localities, I believe, with Forel, that Pergande's observation must be quite exceptional or may even involve some misinterpretation.

20. Leptothorax (Dichothorax) floridanus Emery.

L. (*D.*) *floridanus* Emery, Zool. Jahrb., Abth. f. Syst., VIII, 1894, pp. 318, 324. ☿.

According to Emery, the worker of this species (Pl. XII, figs. 24 and 24*a*) differs from the preceding in the following characters: The body is more shining, the epinotum smooth and shining above, the mesoëpinotal constriction punctulate, subopaque, the petiolar node is narrower, and not impressed above, the postpetiole is hardly ⅓ again as broad as the petiole and proportionally narrower than in *Pergandei*.

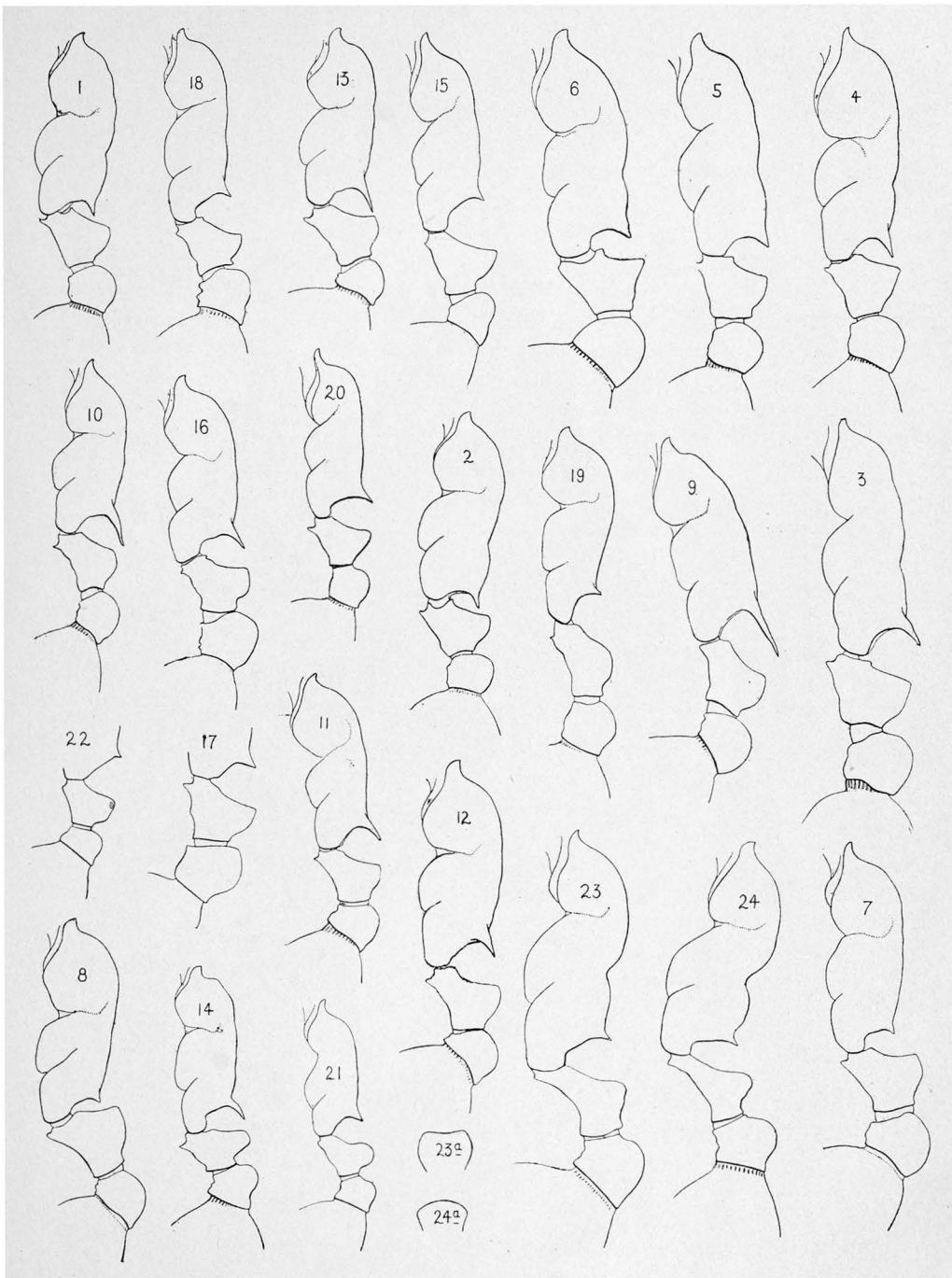
Type locality: Florida (Pergande).

Additional locality: North Carolina (Forel).

The differences between the two *Dichothorax* are so slight that Emery suspected *floridanus* to be merely a subspecies of *Pergandei*. I am myself strongly of this opinion, but as I have seen only a single specimen of *floridanus*, kindly given me by Prof. Forel, I hesitate to reduce this form to subgeneric rank. In my specimen the petiolar node is very decidedly convex when seen from behind, and the epinotal spines are longer and more curved than in any of my specimens of *Pergandei*. In other respects I can see no differences of importance. Color, pilosity and sculpture are the same in both forms.

Explanation of Plate XII.

Fig. 1.—*Leptothorax muscorum* Nylander. Switzerland. In this and the following figures only the profile view of thorax and pedicel (petiole and postpetiole) of the worker are represented. All the figures are from camera lucida drawings.
Fig. 2.—*L. muscorum* var. *sordidus* var. nov.
Fig. 3.—*L. acervorum* Mayr. Switzerland.
Fig. 4.—*L. acervorum* subsp. *Canadensis* Provancher.
Fig. 5.—*L. acervorum* subsp. *Canadensis* var. *Yankee* Emery
Fig. 6.—*L. Emersoni* Wheeler.
Fig. 7.—*L. Schaumi* Roger.
Fig. 8.—*L. fortinodis* Mayr.
Fig. 9.—*L. longispinosus* Roger.
Fig. 10.—*L. curvispinosus* Mayr.
Fig. 11.—*L. curvispinosus* subsp. *ambiguus* Emery.
Fig. 12.—*L. curvispinosus* subsp. *rugatulus* Emery.
Fig. 13.—*L. curvispinosus* subsp. *annectens* subsp. nov.
Fig. 14.—*L. Schmittii* sp. nov.
Fig. 15.—*L. nitens* Emery.
Fig. 16.—*L. texanus* sp. nov.
Fig. 17.—*L. tricarinatus* Emery. (After Emery.)
Fig. 18.—*L. neomexicanus* sp. nov.
Fig. 19.—*L. obturator* sp. nov.
Fig. 20.—*L. nevadensis* sp. nov.
Fig. 21.—*L. terrigena* sp. nov.
Fig. 22.—*L. Andrei* Emery. (After Emery.)
Fig. 23.—*L.* (*Dichothorax*) *Pergandei* Emery. 23*a* node of petiole seen from behind.
Fig. 24.—*L.* (*Dichothorax*) *floridanus* Emery. 24*a* node of petiole seen from behind.



WHEELER ON LEPTOTHORAX.

PSYCHE.

A DECAD OF TEXAN FORMICIDAE.[1]

BY WILLIAM MORTON WHEELER, AUSTIN, TEX.

1. ECITON (ACAMATUS) PAUXILLUM, sp. nov.

Worker. Length 1.75–2 mm.

Mandibles with a very prominent basal tooth. Head, including mandibles, fully twice as long as broad, occipital border slightly concave, posterior angles rather sharp, sides subparallel. Eyes completely absent. Antennal scape thick, not reaching half way to the posterior angle of the head, funiculus robust, first joint nearly as long as the second and third together, joints 2–6 distinctly broader than long; joints 7–9 about as wide as long. Thorax flattened dorsally, laterally compressed, with distinct mesoëpinotal constriction; basal surface of epinotum flattened, longer than the declivity, with which it forms a rounded, obtuse angle. Petiole and postpetiole, whether seen from above or in profile, of similar size and form; each furnished with an anterior ventral tooth; petiole distinctly longer than the postpetiole, longer than broad, subelliptical from above; postpetiole not longer than broad, somewhat wider behind than in front. Gaster elongate elliptical, distinctly flattened dorso-ventrally. Legs short and robust. Claws simple.

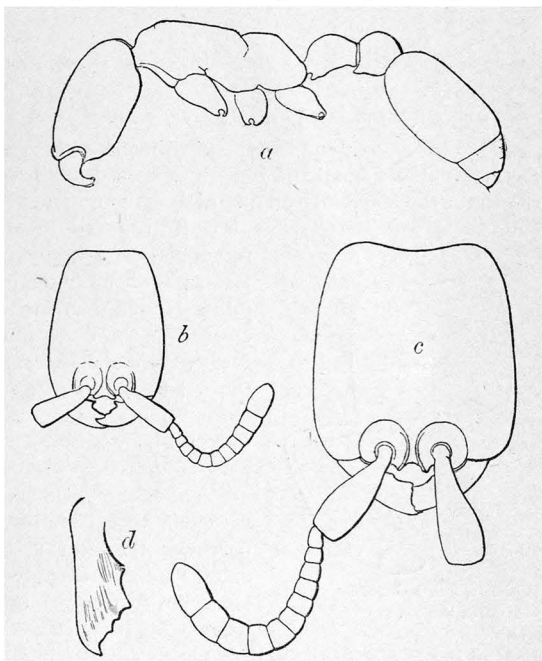


FIG. 1. *a*, Eciton pauxillum, sp. nov. Worker; *b*, head of same; *c*, head of *E. commutatum* Emery; *d*, mandible of same.

Smooth and shining, especially the head and thoracic dorsum; sides of neck, meso- and metapleurae, together with the ventral surfaces of the petiole and postpetiole, distinctly and evenly reticulate. Mandibles, head and thorax with coarse but scattered piligerous punctures.

[1] Contributions from the Zoölogical Laboratory of the University of Texas. No. 49.

Body and appendages covered with sparse and rather long, suberect, yellow hairs.

Reddish yellow throughout except the mandibles, clypeus, and anterior border of the head which are more brownish.

Described from nine specimens taken at Austin, Tex., May 25, 1901; the only occasion on which I have seen this species. The insects were moving along under a stone in a small troop, all the members of which were very nearly of the same diminutive size. The species is evidently hypogaeic in its habits like *E. coecum*, *nitens*, *commutatum*, etc.

It may be distinguished from all our North American Ecitons by its very small size, and from the species above mentioned by its very long, narrow head and the prominent, rather acute basal tooth of the mandibles. Mexican specimens which I assign to *E. commutatum* Emery have the tooth broad and blunt and the head is fully two thirds as broad as long.

2. PONERA INEXORATA, sp. nov.

Worker. Length 2.75–3.25 mm.

Mandibles long and flattened, with concavely sinuate lateral borders and about a dozen teeth, which are small and indistinct towards the base, but longer and more pointed towards the tip of the blade. Head distinctly longer than broad with concave occipital margin and subparallel sides. Clypeus broadly rounded in front, convex in the middle. Antennae rather slender, scape reaching to the posterior angle of the head, joints 2–5 of the funiculus fully as long as broad, the remaining joints longer than broad. Eyes very small, with at most 3–4 ommatidia in their longest diameter and situated about one fourth the distance from the anterior to the posterior border of the head. Thorax with very distinct promeso-notal and meso-epinotal sutures; pronotum broader than the succeeding thoracic segments, rounded, with rather sloping anterior angles; mesonotum convex; epinotum laterally compressed, its basal portion in profile horizontal and nearly straight, its declivity flattened, with rounded sides, not carinate. Petiole decidedly narrower than the first gastric segment, its anterior surface flattened dorsoventrally but distinctly convex from side to side; posterior surface flat in both directions, so that the segment when seen from above is somewhat semi-circular; seen from behind the border of the node is nearly circular in outline. Gaster of the usual form. Legs moderately stout, each tibia with a pair of spurs, one of which is pectinated.

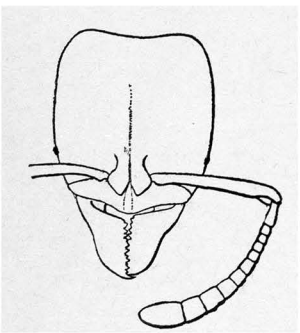


FIG. 2. *Ponera inexorata*, sp. nov. Head of worker.

Surface of the body, especially the dorsal surface of the head, thorax, and petiole, shining. Mandibles with coarse, scattered, piligerous punctures. Head covered rather densely but not confluently with coarse piligerous punctures or small foveolae. Pronotum with similar but smaller and sparser punctures; neck and mesonotum finely corrugated above; meso- and

metapleurae similarly but more coarsely sculptured, subopaque. Petiole and gaster covered with piligerous punctures like those on the pronotum.

Whole body clothed with pale yellow, reclinate or appressed hairs, among which there are longer, more scattered, suberect hairs, especially on the thorax and abdomen.

Yellowish ferruginous throughout, mandibles, antennae, and legs somewhat paler. Epinotum, mesopleurae, and posterior gastric segments sometimes more reddish or brownish. Teeth of mandibles and anterior border of clypeus blackish.

Female (deälated). Length 3.25 mm.

Very much like the worker in form and coloration. Each ocellus with a small black spot at its margin. Head distinctly more opaque than in the worker, owing to a denser aggregation of the piligerous foveolae; the node is thinner antero-posteriorly and its anterior surface is very flat or even slightly concave from side to side. Alar insertions black.

Described from two females and numerous workers taken at Austin, San Angelo, and Fort Davis. The species is not common. It occurs in colonies not exceeding a dozen individuals and usually much smaller. I have found it only on dry hill-slopes under rather small stones (limestone in central Texas, volcanic rock in the Trans-Pecos).

P. inexorata is closely related to *P. distinguenda* Emery of Venezuela, Brazil, and Paraguay, but is smaller and yellowish ferruginous in color instead of fuscous.

3. PHEIDOLE TITANIS, sp. nov.

Soldier. Length 7.25–8 mm.

Head proportionally small, hardly larger than the gaster, a little longer than broad, excluding the mandibles, subcordate, somewhat broader behind than in front, with prominent rounded posterior corners; posterior border deeply excised in the middle. A deep groove extends from this excision to the frontal area. Mandibles robust, convex, with flattened, edentulous, and nearly straight blades which terminate in two prominent apical teeth. Clypeus short, its anterior border deeply excised in the middle, feebly and sinuately concave on either side; median surface rather flat and depressed. Frontal area triangular, as long as wide. Frontal carinae long, diverging, continued backward nearly to the middle of the head. Antennae very small, scape distinctly flattened but hardly incrassated, reaching only to a little beyond the posterior orbit; funiculus slender, its joints all decidedly longer than broad, club very short and indistinctly marked off from the remainder of the funiculus. Eyes moderate, round, at about one third the distance from the anterior to the posterior border of the head.

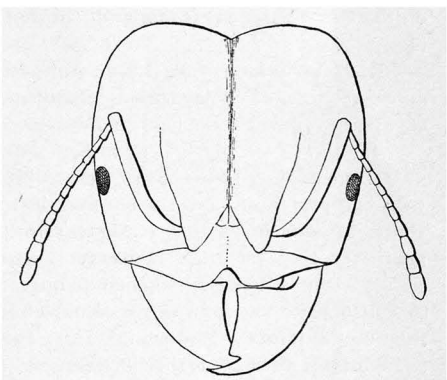


FIG. 3. *Pheidole titanis*, sp. nov. Head of soldier.

Thorax robust; pronotal angles obtusely rounded; mesoëpinotal constriction rather deep; epinotal declivity concave; spines robust, pointed, longer than broad at the base and farther apart than long; slightly curved downwards at their tips. Petiole pedunculate, seen from above constricted near the middle; in profile the dorsal surface is concave in front, convex on the anterior surface of the node, posterior declivity straight and abrupt; upper margin of node distinctly concave in the middle when seen from behind. Postpetiole transversely elliptical from above, nearly twice as broad as long and fully twice as broad as the petiole, with distinct but not very prominent lateral angles near the middle; in profile the dorsal surface is very convex, the ventral surface much more flattened. Gaster elongate elliptical, rather large. Legs long, femora conspicuously incrassated in the middle, the tibiae towards their distal ends.

Mandibles smooth and shining, with a few scattered piligerous punctures and some pronounced striae on the outer basal margin. Clypeus shining in the middle, more opaque at the sides which are coarsely longitudinally rugose. There is a prominent median ruga. Frontal area shining, with a median carinula. Head subopaque covered with rather coarse, parallel, longitudinal rugae over the anterior three quarters, posterior fourth smooth and shining, with a few scattered and shallow foveolae. Spaces between the rugae filled with minor reticulations which extend back somewhat beyond the ends of the main rugae on to the smooth occipital surface. Thorax subopaque, pro- and mesonotum more shining, pronotum and sides of mesonotum with several sharp transverse rugae. Mesopleurae and whole epinotum coarsely punctate rugulose. Petiole and postpetiole opaque, punctate rugulose throughout. Gaster hardly shining, as its surface is finely reticulate and irregularly and rather densely punctate; only the basal portions of the segments where they are overlapped by preceding segments when the gaster is not distended, are smooth and shining. Antennae and legs smooth and shining, scape, tibiae, and femora with scattered piligerous punctures.

Whole insect covered with rather long, coarse, yellow hairs, which are erect or suberect on the body, antennal scape, and legs, but shorter and less conspicuous on the funiculus and tarsi.

Rich ferruginous red, thorax and petiole somewhat darker, edges of mandibular blades, anterior border of clypeus, epinotal spines and gaster black, the posterior edges of the gastric segments yellowish, the basal half of the first gastric segment sometimes ferruginous.

Worker. Length 4–4.5 mm.

Head, excluding the mandibles, as broad as long; posterior angles rounded. Mandibles with two prominent apical teeth and the remainder of their blades finely crenulate. Clypeus short, its anterior border straight, faintly and sinuately excised in the middle, posterior median surface strongly convex. Frontal area triangular, rather indistinct. Antennae slender, scape slightly thickened distally, extending beyond the posterior corner of the head to a distance about one third of its length; funiculus with all its joints distinctly longer than broad, joints 2–7 subequal, fully twice as long as broad; club appearing 4-jointed as the 8th joint forms a transition between the basal and terminal joints. Thorax much like that of the soldier, but with less robust and narrower prothorax; epinotal spines more slender, straight and pointed. Petiole slender, more than twice as long as broad, node rounded, hardly transverse. Postpetiole as long as broad, campanulate, nearly twice as broad as the petiole. Gaster and legs of the usual shape.

Smooth and shining; mandibles, head, and gaster with sparse piligerous punctures; head in front of eyes longitudinally rugose as is also the region between and next to the

frontal carinae. Mesopleurae, epinotum, ventral and lateral surfaces of the petiole and postpetiole subopaque, reticulate punctate.

Pilosity similar to that of the soldier but less abundant.

Black or very dark reddish brown. Mandibles, anterior portion of head, pro- and mesopleurae reddish yellow. Antennae and legs reddish yellow, scape and femora darker.

Described from numerous specimens taken in the Paisano Pass, Brewster County, by myself, and in the Chisos Mts. by Judge O. W. Williams. The single nest found in the Paisano Pass was between huge immovable boulders embedded in the soil, so that I could secure only the workers, but Judge Williams obtained great numbers both of the soldiers and workers from a large nest under a stone near the foot of the Chisos.

Ph. titanis differs from all the other species of PHEIDOLE known to occur in the United States in its great size. It belongs to the group of species comprising *Ph. hyatti* Emery and *Ph. crassicornis* Emery. The soldier of *Ph. titanis* resembles the soldiers of both of these species in the relatively small size and sculpturing of the head, and the flattened antennal scape, but differs in the peculiar, short, and indistinct antennal club and the deep median excision of the anterior clypeal border.

4. PHEIDOLE TEXANA, sp. nov.

Soldier. Length 4–5 mm.

Head rather small, but larger than the gaster, a little longer than broad, excluding the mandibles, cordiform, distinctly broader behind than in front, with deeply excised posterior border, rounded posterior angles, and a rather broad median furrow extending from the frontal area to the occiput. Frontal area triangular, about as broad as long. Clypeus short, its anterior border flattened and rather deeply notched in the middle. Frontal carinae short, prominent. Eyes moderate, well in front of the middle of the sides of the head. Mandibles large, convex with flattened blades, which are finely denticulate basally, with two prominent terminal teeth. Antennal scape broadened and flattened, distinctly concave on its anterior surface, hardly reaching to half the distance between the eye and the posterior corner of the head, funiculus with all its joints longer than broad, the last three joints forming a well-developed club. Thorax not very robust, pronotal angles rounded, pronotum rather flattened above; mesonotum angular, projecting upward, concave in the middle when seen from behind; separated by a distinct suture from the pronotum and by a more distinct constriction from the epinotum. The latter has its basal surface and declivity both in the same plane, gradually sloping backwards and distinctly concave; spines well developed, blunt, longer than broad at

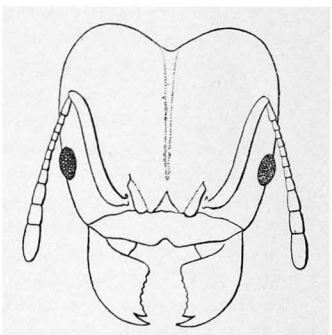


FIG. 4. *Pheidole texana*, sp. nov. Head of soldier.

their bases and much farther apart than long, directed upwards, backwards, and outwards. Petiole in profile with long concave ascending nodal surface and convex ventral surface; the node is acute, transverse, with median emargination and short, concave posterior declivity; seen from above the petiole is small, not more than one and a half times as long as broad, broader behind than in front, constricted in the middle, with rather acute posterior angles. Postpetiole three times as broad as the petiole and more than twice as broad as long, with a small, acute projection in the middle on either side; in profile the dorsal surface is evenly convex and longer than the more uneven ventral surface. Gaster rather large, elliptical, flattened on its dorsal surface. Legs of moderate length and of the usual conformation.

Mandibles shining, indistinctly reticulate, covered with large piligerous punctures. Clypeus shining in the middle, faintly reticulate like the mandibles, on either side with a few coarse longitudinal rugae. Frontal area impressed, shining, with a few longitudinal rugae on either side. Head opaque throughout, covered with coarse reticulate rugae enclosing more finely reticulate interrugal spaces; the main rugae with distinctly longitudinal trend only on the front and cheeks. Cephalic furrow crossed by numerous transverse rugae especially towards the occipital border. Antennal scape shining, finely reticulate. Thorax, petiole, and postpetiole opaque like the head, but more finely reticulate rugose; only the dorsal surfaces are roughened, the pro- and mesonotum being crossed by a few coarse and irregular transverse rugae. Postpetiole with about eight shallow longitudinal impressions on its dorsal surface. Gaster and legs shining, their surfaces finely and regularly reticulate.

Body and appendages invested with rather long, more or less erect, tawny hairs.

Rich ferruginous red throughout; legs and antennae but little paler than the body; gaster somewhat infuscated posteriorly, anteriorly pellucid and in many specimens appearing as if filled with a wine-red fluid so that this region has a more brilliant color than the remainder of the body.

Worker. Length 2.5–3. mm.

Head but little longer than broad, its posterior border rather straight but not concave. Mandibles rather slender, 8-toothed, the first, second, and fourth teeth from the apex being longer than the others. Clypeus sinuately emarginate in the middle, with a median and on either side two lateral longitudinal ridges or carinulae. Frontal area triangular, as long as broad, with a median longitudinal ridge. Antennal scapes not flattened, distinctly enlarged at their distal ends; exceeding the posterior angles of the head by somewhat more than twice their transverse diameter. Pronotum rounded above and on the sides, spheroidal; mesonotum projecting upwards as a transverse ridge which is not concave in the middle when seen from behind, separated by distinct constrictions from the pro- and epinotum. The latter shaped like that of the soldier. Petiole slender, fully twice as long as broad, in other respects like the corresponding segment of the soldier. Postpetiole nearly three times as broad as the petiole, hardly twice as broad as long, its sides and dorsal surface rounded, the angles of the former being very indistinct.

Sculpture like that of the soldier but feebler, especially on the head. Pilosity and color, too, as in the soldier, except that there is a large black spot on the vertex in many specimens.

Described from numerous soldiers and workers. These were taken from four nests, the only ones I have seen during as many years. They were all situated in

different parts of Travis County, Texas, in open, sunny grass-lands. Each nest was surmounted by a regular moundlet about four inches in diameter and consisting of coarse pellets of earth. The ants are very pugnacious but their stings are feebly developed.

Ph. texana, like the preceding species, belongs to the group comprising *Ph. hyatti* and *Ph. crassicornis*, on account of the flattening of the antennal scape in the soldier, the relatively small head, etc. *Ph. texana*, however, is readily distinguished by the coarse reticulation covering the whole head and leaving no polished posterior angles, and by the antennal scape which is intermediate in length between that of *Ph. hyatti* and *Ph. crassicornis*.

5. MACROMISCHA SUBDITIVA, sp. nov.

Worker. Length 2–2.5 mm.

Head somewhat longer than broad, rounded at the posterior angles and convex above. Mandibles rather small, with three acute apical and three much smaller basal teeth. Clypeus short, broadly rounded in front, convex in the middle, with a prominent median carina running its full length and continued over the frontal area. Frontal area large, triangular, longer than broad. Antennae long, 12-jointed; scape extending beyond the posterior corner of the head to a distance equal to twice its breadth; first funicular joint nearly as long as the three succeeding joints together, joints 2–8 about as long as broad, two penultimate joints subequal, together as long as the terminal joint. Thorax short and thick-set, dorsum in profile convex, evenly rounded; prothorax with broadly rounded angles, promesonotal suture very faintly, mesoëpinotal suture somewhat more distinctly indicated. Epinotum armed with two stout spines, which are very close together at their bases but diverge strongly outward, upward, and backward; epinotal declivity concave. Petiole long, with a conspicuously elongated peduncle which passes very abruptly into the transverse node; the latter is much compressed antero-posteriorly when seen in profile, the anterior and posterior surfaces being flattened and perpendicular, the summit of the node narrow and rounded; when seen from behind, the edge of the node is horizontal and nearly straight. There is a small but distinct tooth on the ventral surface of the petiole near its anterior end. Postpetiole from above but little wider than the node of the petiole, fully twice as broad as long, rounded oblong; in profile it is nodiform, very convex dorsally, in both views showing a decided constriction at its insertion into the gaster. Gaster of the usual shape, with a long, powerful sting. Legs of the usual shape, with the femora conspicuously incrassated in the middle. There are no spurs on the middle and hind tibiae.

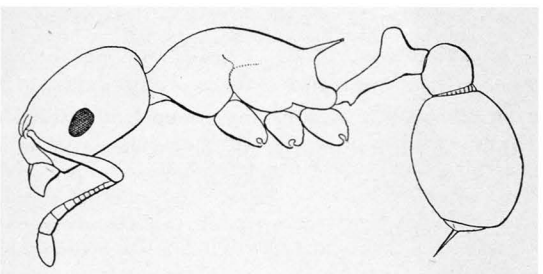


FIG. 5. *Macromischa subditiva*, sp. nov. Worker.

Head, including the mandibles and clypeus, subopaque, sharply longitudinally rugose; the rugae connected by subsidiary reticulate rugae on the base of the mandibles, cheeks, and sides of the head. Clypeus and frontal area more shining, the former with few rugae, especially near the middle. Thoracic dorsum shining, pleurae and epinotum subopaque. Whole surface of thorax reticulate rugose, regularly in the opaque regions, more irregularly and more longitudinally on the shining dorsal surface. Petiole and postpetiole shining above, reticulate and subopaque on the ventral and lateral surfaces. Gaster very smooth and shining. Legs more opaque, finely but distinctly reticulate.

Head, thorax, and abdomen beset with sparse, erect, obtuse, silvery white hairs; antennae and legs with minute, appressed, pointed hairs of the same color.

Body black or, in immature specimens, very dark brown; mandibles, antennae, legs and epinotal spines, tip of gaster, and sting yellow, scape and club of antennae, bases of epinotal spines, and greater portion of femora and tibiae infuscated.

A rare species described from a few specimens taken along Walnut Creek, near Austin (May 12, 1901), and at New Braunfels (June 3, 1901). In the former locality they were found walking on the leaves of bushes, in the latter on a dead limb lying on the ground. I did not succeed in finding the nest which is probably small and not very populous.[1]

This is the first species of MACROMISCHA to be described from the United States, and I am not altogether sure that it is to be assigned to this neotropical genus. It certainly resembles some of our species of LEPTOTHORAX with 12-jointed antennae, like *L. obturator* Wheeler. Emery maintains that MACROMISCHA differs from the other myrmicine genera in the following characters: 1. the petiole has a long peduncle; 2. the postpetiole is campanulate and attached by its whole breadth to the first gastric segment; 3. the thoracic dorsum is continuous, *i. e.*, without sutures or constrictions; and 4. there are no spurs on the middle and hind tibiae. *M. subditiva* does not present the second and third of these characters, but it certainly differs from our species of LEPTOTHORAX in the remarkable shape of the petiole.

6. ATTA (TRACHYMYRMEX) TURRIFEX, sp. nov.

Worker. Length 3–3.75 mm.

Mandibles long, pointed, 7–8 toothed. Clypeus short, with a deep excision in the middle of its anterior border. Head with pointed posterior angles, deeply excised occipital margin and rather straight, subparallel sides. Frontal carinae large, suboblong, conspicuously concave on their upper surfaces, and continued back to the posterior angles of the head as prominent crenated ridges, on either side bounding a marked concavity for the recep-

[1] Since the above was written I have succeeded in finding a single nest of *M. subditiva*. This was a small cell excavated in the bark of a huge willow (*Salix nigra*) near Austin. The cell contained about twenty workers and resembled in every way the nests of our corticolous species of LEPTOTHORAX.

tion of the antennal scape when folded back. Just behind the posterior angle of the head there is a prominent projection. Antennal scape robust, hardly extending beyond the posterior corner of the head; funiculus long, its joints all distinctly longer than broad. Pro- and mesonotum high, arched dorsally above the epinotum which is separated by a deep constriction from the mesonotum and has its basal surface of about the same length as its abrupt and somewhat concave declivity. Sides of mesonotum carinate. The thorax is armed with the following prominent spines and protuberances: pronotum with two spines on either side and a double tubercle in the mid-dorsal line: mesonotum with a large blunt tubercle at either anterior corner and farther back a pair of smaller spine-like tubercles which are much closer together than the anterior pair; epinotum with a pair of prominent spines, the bases of which are continued forward as ridges bordering the basal dorsal surface of the epinotum. These spines are longer than their distance apart at their bases, and are directed outwards, backwards, and upwards. Petiole in profile depressed, the pedicel rising gradually into the somewhat rounded node, sides subcarinate, ventral surface with a small acute tooth at the extreme anterior end; seen from above the node is oblong, distinctly longer than broad. Postpetiole nearly twice as broad as long, its anterior border rounded, its posterior border straight, with a large depression in the mid-dorsal line; the sides are distinctly carinate. Gaster somewhat oblong when seen from above, slightly flattened; in profile more pyriform, sides faintly carinate. Legs of the usual conformation.

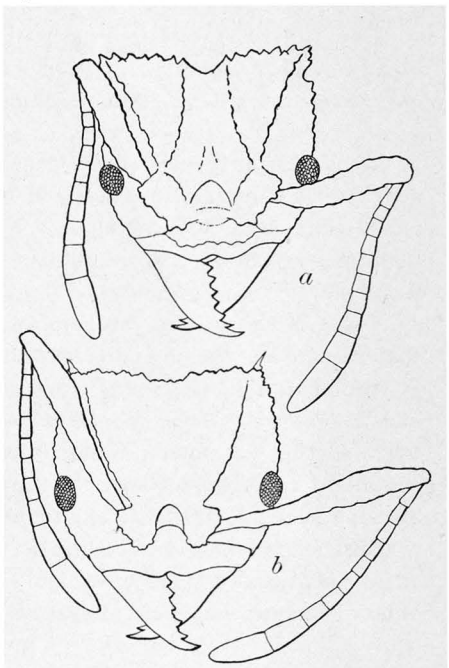


FIG. 6. *a*, *Atta* (*Trachymyrmex*) *turrifex*, sp. nov. Head of worker. *b*, *A.* (*T.*) *septentrionalis* McCook. Head of worker.

Mandibles subopaque, finely striated, the edges of the blades with a row of shallow, elongate depressions. Body, legs, and antennal scape opaque, roughened, covered with small tubercles, which are more or less connected by low confluent ridges on the head and thorax. Even the thoracic spines are covered with these tubercles. On the gaster they are very uniformly distributed. Funicular joints smooth.

Hairs rather uniformly covering the body, legs, and antennal scape, brown, short, and more or less recurved or hooked.

Rich reddish brown throughout; teeth of mandibles and dorsal surface of head between the frontal carinae, black. In old specimens the body is much darker in color and its roughened portions are overlaid with a bluish bloom which is intensified when the insect is boiled in caustic potash. Young specimens are paler yellowish brown.

Female. Length 4–4.5 mm.

Very similar to the worker in the structure of the head, pedicel, gaster, and appendages. Pronotum with a prominent tubercle on either side, mesonotum and paraptera flat, without

spines or prominent tubercles; scutellum continued back as a pair of flat, triangular projections. Spines on the epinotum very robust. Wings fully 5 mm. long; extending far beyond the tip of the gaster, yellowish white, opaque, like ground glass; veins brownish, insertions black.

I have taken this new fungus-growing ant in the following localities in Texas: Fort Stockton, Pecos County; Del Rio, and Langtry, Valverde County; Marfa, Presidio County; Marble Falls, Burnet County and in many places in the vicinity of Austin, Travis County. It is nowhere very abundant and is easily overlooked on account of its extremely retiring disposition. Its nests and mushroom gardens, which I hope to describe at length in another place, are similar to those of *Atta septentrionalis* McCook. The entrance to the nest is very often surmounted by a peculiar turret, sometimes 1¼ inches high and built of little twigs, leaves, etc.

Atta turrifex is a well-marked species. The worker differs from the worker of *A. septentrionalis* and the Mexican *A. saussurei* Forel in the following characters: The antennal scape is much shorter, hardly reaching beyond the posterior angle of the head, the lobes of the frontal carinae are broader and more concave, the posterior angles of the head are more acute, the sides of the head are straight and not rounded. The spines on the pro- and mesonotum are longer and of a different conformation, the postpetiole is conspicuously shorter, the general color of the body is darker, and there is no dorsal black band on the gaster. The characters of the head alone, as shown in the accompanying camera sketches of *A. turrifex* and *A. septentrionalis*, will suffice to separate the species at a glance. There are corresponding differences between the females of the two species.

As I have at last discovered *A. septentrionalis* in Texas (at Milano and Denton), it is clear that Buckley's name *A. tardigrada*, usually applied to this species, should be given up, since there is no way of deciding to which of the two species, his very inadequate description refers.

7. Brachymyrmex nanellus, sp. nov.

Worker. Length 1 mm.

Mandibles 5-toothed, median tooth minute. Head about as broad as long, clypeus broadly rounded in front, its anterior border with a sinuous impression on either side. Antennal scape reaching to the posterior corner of the head, funiculus rather short and thick, joints 2–6 not longer than broad. Eyes with rather large ommatidia of which there are only about six in the maximum diameter. Maxillary palpi short, the three terminal joints less than one and a half times as long as broad. Promesonotal and mesoëpinotal sutures distinct, the latter deeper, very conspicuous, and constricted. Petiole seen from behind, oblong but little higher than broad.

Whole body smooth and shining, gaster somewhat more opaque.

Clothed with delicate, appressed, yellowish hairs; on the clypeus and mandibles the hairs are longer and suberect. Each gastric segment bears on its posterior edge a row of prominent hairs.

Pale yellow, dorsal surface faintly tinged with brown; teeth and edges of mandibular blades black.

Male. Length 1 mm.

Mandibles spatulate, their rounded, edentulous blades not meeting with their tips. Clypeus short, with straight anterior border. Antennal scape slender, reaching a little beyond the posterior angle of the head, funiculus with basal joint twice as long as broad and more robust than any of the succeeding joints, joints 2 and 3 hardly longer than broad, joints 4–8 less than one and one half times as long as broad, terminal joints slender, a little shorter than the three preceding joints together. Mesonotum large, overarching the small head, so that it is not seen when the insect is viewed from above. Epinotum flattened. Petiole rather long and thick, anterior surface of node somewhat concave, posterior surface longer and like the ventral surface, convex. Outer genital appendages robust, rounded.

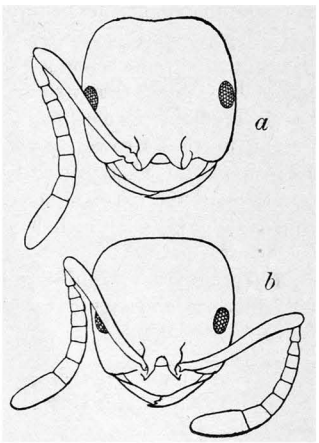


FIG. 7. *a*, *Brachymyrmex heerii* Forel. subsp. *depilis* Emery. Head of worker. *b*, *B. nanellus*, sp. nov. Head of worker.

Surface smooth and shining, gaster somewhat more opaque.

Pilosity like that of the worker. There are two widely separated, prominent bristles on the disc of the scutellum. Genital appendages fringed with prominent hairs. Wings microscopically pilose, the posterior pair especially fringed along their anal borders with rather long white hairs.

Pale yellow, head brown especially in the ocellar region. Wings and their nervures colorless.

Described from one male and a dozen workers taken under stones in a rather dry open place at Austin, May 25, 1901. The species is certainly rare in central Texas.

B. nanellus is closely related to *B. heerii* Forel subsp. *depilis* Emery, the only other member of the genus known to occur in the United States. The worker *nanellus* is distinguished by its much smaller size (*B. heerii depilis* measures 1.5–2 mm.), the shorter funicular joints and maxillary palpi, and the much paler color (*depilis* is distinctly brown). The male is also much paler in color than the male of *depilis*. It is possible that *nanellus* may have to be reduced to the rank of a subspecies of *heerii*, when the various species of the extremely difficult American genus BRACHYMYRMEX are subjected to a careful comparative study.

8. PRENOLEPIS MELANDERI, sp. nov.

Worker. Length 2–2.5 mm.

Mandibles 6-toothed, with oblique blades; third and fifth tooth from the apex distinctly smaller than the others. Clypeus convex, hardly carinate, its anterior border sinuately excised in the middle. Head, exclusive of the mandibles, about as long as wide, distinctly narrower in front than behind, occipital border feebly and sinuately excised. Antennae long, scape extending for somewhat more than a third of its length beyond the posterior corner of the head, all the joints of the funiculus distinctly longer than broad; joints 3–10 subequal. Thorax rather slender, dorsal surfaces of pro- and mesonotum somewhat flattened, the sides of the former rounded. Mesoëpinotal suture distinct but not flattened at the bottom, much narrower than the distance between the pair of metathoracic stigmata. Epinotum rounded above and on the sides, its declivity flattened or somewhat concave. Petiole small and narrow, cuneate in profile, inclined forward, its ventral surface convex, the edge of the node seen from behind rounded rather than horizontal. Gaster and legs of the usual conformation.

Body smooth and shining, legs and antennae subopaque.

Antennae and legs covered with delicate appressed, whitish pubescence; head, thorax,

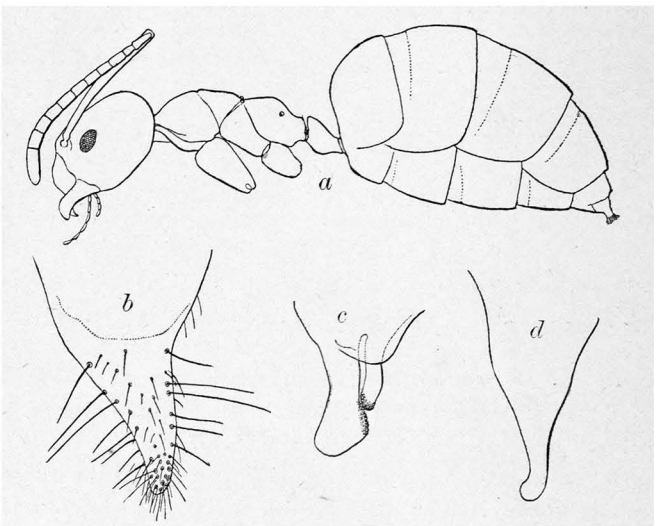


FIG. 8. *a, Prenolepis melanderi,* sp. nov. Worker. *b,* external; *c,* median, *d,* inner genital appendages of male.

and gaster with stout, erect, subobtuse hairs of a brownish or black color in certain lights, except on the posterior portion of the head where they are white. Antennal scape, femora, and tibiae also furnished with more scattered, shorter, suberect hairs.

Yellow; dorsal surface of head, thoracic dorsum, pleurae, and gaster more or less

infuscated. In many specimens the gaster and head are dark brown or black; usually in mature specimens the gaster is darker than the head, the head darker than the thorax.

Female. Length 3–4 mm.

Mandibles 6-toothed, shaped like those of the worker. Clypeus very prominent in the middle, subcarinate, its anterior border feebly excised in the middle. Head, exclusive of the mandibles and clypeus, distinctly broader than long, and narrower in front than behind. Antennae like those of the worker. Thorax broader than the head, with flattened mesonotum and scutellum. Epinotum regularly convex above, its basal surface very short, its declivity somewhat flattened but not concave. Petiole like that of the worker. Gaster of the usual shape in females of PRENOLEPIS.

Surface of body and appendages opaque, except the declivity of the epinotum which is polished and shining.

Grayish yellow pubescence covering the insect more abundant and longer than in the worker. The long hairs, corresponding to those of the worker, are relatively shorter, less obtuse and of a pale color like the pubescence.

Body dark brown, antennae, legs, lower surface and sides of head, mesonotum, and scutellum reddish. The coxae, femora, and tibiae are sometimes slightly infuscated. Wings yellowish gray, rather opaque with yellowish brown nervures and stigma.

Male. Length 1.5–2 mm.

Mandibles well developed, but edentulous. Clypeus like that of the worker but shorter and with more distinct median incisure. Head, except for the much larger eyes and the ocelli, somewhat like that of the worker in shape. Antennal scape reaching for nearly half its length beyond the posterior corner of the head. Mesonotum broad, rounded and convex in front, but depressed just in front of the very convex scutellum. Basal surface of epinotum rather long, flattened; the declivity perpendicular. Petiole thicker and blunter above than in the worker. Outer genital appendages triangular, tapering, longer than broad, a little recurved so that their anterior border is convex, the posterior concave. Median appendages bifurcated, short, the inner ramus broadly club-shaped at the apex, papillose on its external border; lateral ramus digitiform, much shorter than the inner ramus, with its end papillose. Inner genital appendages long, triangular, with a rounded knob at the somewhat recurved apex. When *in situ* the tips of these appendages may project beyond the larger external pair. Legs long and slender, wings like those of the female.

Head, thorax, and abdomen smooth and shining, the surface delicately reticulate. Antennae and legs more opaque.

Pubescence and pilosity as in the worker, except that the erect hairs on the body are relatively shorter, more tapering, and less conspicuous. The hairs on the outer genital appendages, though numerous, are not more prominent than those on the gaster.

Coloration like that of the worker except that the gaster is darker, and usually quite black; the head is dark brown, the thorax somewhat paler. Antennae and legs more or less infuscated. Outer genital appendages dark brown, median and inner pairs pale yellow. Wings colored like those of the female but with very pale and indistinct nervures.

Described from numerous specimens of all the sexual forms from the following localities: San Angelo, Tom Green County; Austin and environs, Travis County; New Braunfels, Comal County, and Fort Davis, Jeff Davis County. I have also received this species from Mr. C. H. Tyler Townsend who collected it in Mexico on the Rio Santa Maria and at Cerro del Chilicote, Chihuahua.

The species, which I take pleasure in dedicating to my former pupil, Mr. A. L. Melander, is very common in central and Trans-Pecos Texas, where it occurs under stones, usually in rather damp localities but not infrequently also on the sun-scorched limestone hills at an altitude of 1000–5000 ft. Its colonies are seen most frequently during the moister seasons of the year and like the colonies of most of our Texan Camponoti contain males and winged females during the winter and early spring months (January to April 1st).

P. melanderi can be readily distinguished from *P. parvula* Mayr in having prominent hairs on the antennal scape in the worker, and in the male by the characteristic genital appendages which are very unlike those of the male *parvula.*

The species above described may be identical with the form described by Buckley as *Formica terricola*, but as this cannot be proved with certainty, since he would be a bold man who would pretend to recognize a particular species of so difficult a genus as PRENOLEPIS among the descriptions of that author, I have decided to reject Buckley's name and redescribe the species.

9. PRENOLEPIS BRUESII, sp. nov.

Worker. Length 2.5–2.75 mm.

Mandibles 6-toothed; third and fifth tooth subequal, much smaller than the others. Clypeus very convex but not carinate in the middle, its anterior border sinuately excised. Head, excluding the mandibles, distinctly longer than broad, not narrower in front than behind, occipital margin feebly excised. Antennal scape reaching to somewhat more than a third of its length beyond the posterior corner of the head; all the funicular joints longer than broad. Thorax rather robust, pro- and mesonotum flattened above, the former broad and rounded on the sides; mesoëpinotal suture pronounced but without a flat bottom, decidedly narrower than the distance between the pair of metathoracic stigmata. Epinotum evenly rounded, its most prominent portion lower than the mesonotal surface, its declivity somewhat flattened. Petiole robust, inclined forward, convex on its ventral surface, its node rather blunt in profile, its upper border horizontal when seen from behind and with rather square corners. Gaster and legs of the usual conformation.

Very smooth and shining, legs and antennae subopaque, gaster delicately reticulate under a high magnification.

Legs and antennae clothed with fine, white, appressed pubescence; head, thorax, and gaster with erect brown hairs which are distinctly longer, more tapering, and more numerous at least on the head, antennal scape, and gaster than in *P. melanderi.*

Yellowish brown, head somewhat darker above, gaster blackish, legs and antennae yellow.

Female. Length 3.75 mm.

Resembling the female of *P. melanderi* but more robust and of a different color. The head is somewhat shining. Mouth, sides of clypeus, and mandibles pale yellow, the last with black teeth. Head, thorax, and gaster black; mesonotum, borders of the scutellum, and

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